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The Bulletin of the University of Minnesota

*The College of Agriculture, Forestry,
and Home Economics
Announcement of
Courses in Agriculture for the Year
1920-1921*



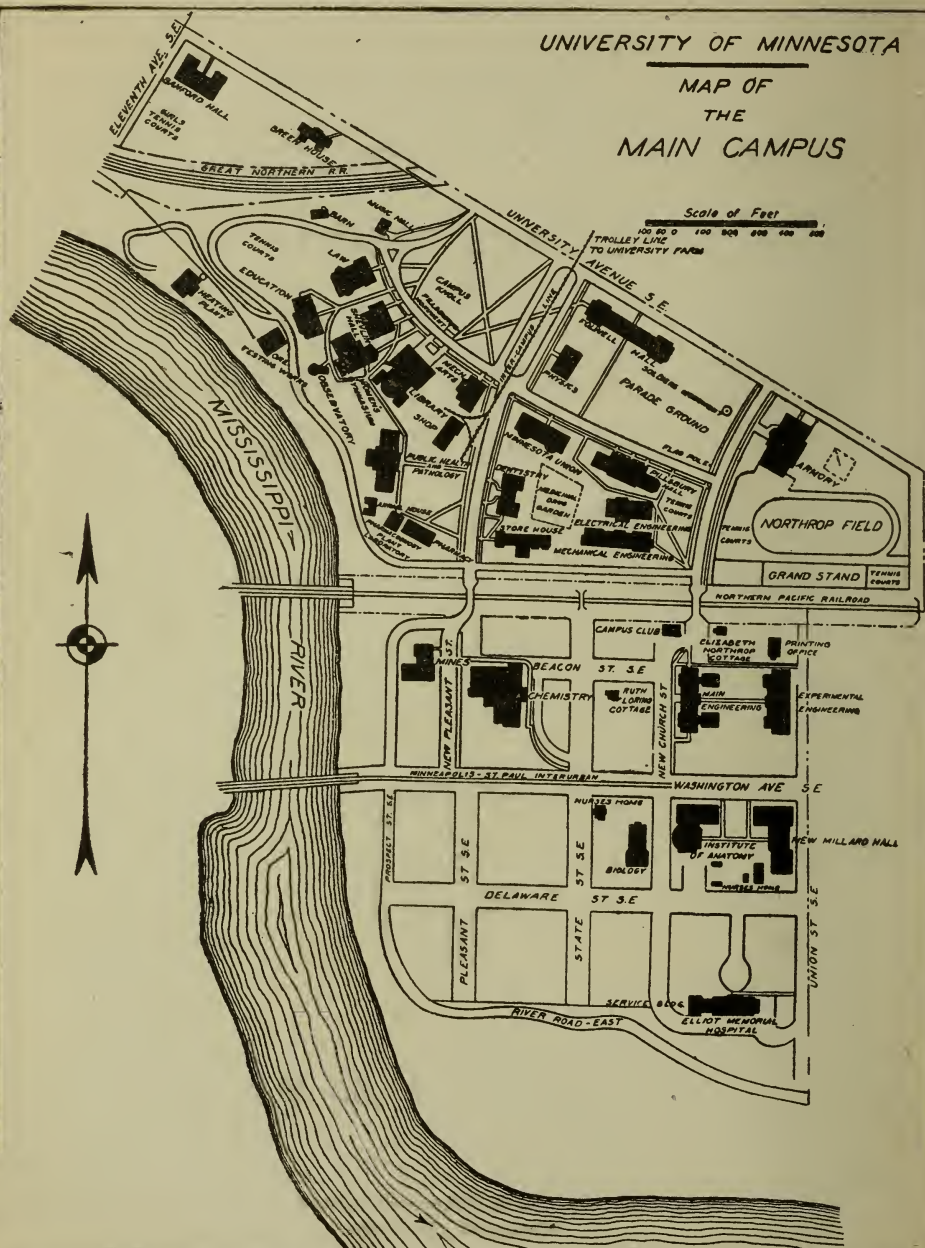
Vol. XXIII No. 27 July 10 1920

*Entered at the post-office in Minneapolis as second-class matter
Minneapolis, Minnesota*

*Accepted for mailing at special rate of postage provided for in section 1103,
Act of October 3, 1917, authorized July 12, 1918*

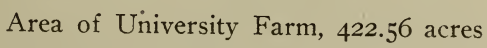
UNIVERSITY OF MINNESOTA

MAP OF THE MAIN CAMPUS



Area of Main Campus, 108.5 acres

A horizontal scale bar with the text "Scale of Feet" centered above it. The bar has markings at 100, 200, 300, 400, and 500. There are also smaller markings at 50 and 0. The bar is divided into segments by vertical lines.



CALENDAR

1920-1921

1920

September	15	Wednesday	Registration closes except for new students
September	21-28	Week	Examinations for removal of winter and spring quarter conditions and entrance examinations Registration of new students. Payment of fees
September	29	Wednesday	Fall quarter begins, 8:15 a.m.
October	4	Monday	School of Agriculture, first term begins
October	15	Friday	Half holiday, annual freshman-sophomore contest
October	21	Thursday	Senate meeting, 4:30 p.m.
October	29	Friday	Last day for removal of spring quarter incompletes
November	2	Tuesday	Election Day; a holiday
November	15-27		Advanced Creamery Operators' Short Course
November	15 }		Advanced Cheese-Makers' Short Course
December	1 }		
November	25	Thursday	Thanksgiving Day; a holiday
November	29 }	Week	Ice-Cream Makers' Short Course
December	4 }		
December	6-11	Week	Milk Plant Operators' Short Course
December	16	Thursday	Senate meeting, 4:30 p.m.
December	21	Tuesday	Last day for winter quarter registration except for new students
December	22	Wednesday	Fall quarter closes, 5:20 p.m. School of Agriculture, first term closes Christmas vacation begins, 5:20 p.m.
December	27 }	Week	Registration of new students. Payment of winter quarter fees
January	3 }		

1921

January	3-8	Week	Farmers' and Home-Makers' Week Short Course
January	3 }		Beginning Creamery Operators' Short Course
February	12 }		
January	3-8		Threshermen's Short Course
January	3-8		Traction Engineering Short Course
January	4	Tuesday	Winter quarter begins, 8:15 a.m.
January	10	Monday	School of Agriculture, second term begins

February	1	Tuesday	Last day for removal of fall quarter incompletes
February	12	Saturday	Lincoln's Birthday; a holiday
February	17	Thursday	Senate meeting, 4:30 p.m.
February	22	Tuesday	Washington's Birthday; a holiday
March	16	Wednesday	Last day for spring quarter registration except for new students
March	24	Thursday	Winter quarter closes, 5:20 p.m. Spring vacation begins
March	24-29	Week	Registration of new students. Payment of spring quarter fees
March	30	Wednesday	Spring quarter begins, 8:15 a.m. School of Agriculture, second term closes
April	4-9		Boys' and Girls' Week Short Course
April	27	Wednesday	Last day for removal of winter quarter incompletes
May	19	Thursday	Senate meeting, 4:30 p.m.
May	30	Monday	Memorial Day; a holiday
June	12	Sunday	Baccalaureate service
June	14	Tuesday	Spring quarter closes
June	15	Wednesday	Forty-ninth annual commencement
June	17-18		Summer session registration. Payment of fees
June	20	Monday	Summer session begins
July	30	Saturday	Summer session closes

THE COLLEGE OF AGRICULTURE, FORESTRY, AND HOME ECONOMICS

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 ELVIN C. STAKMAN, Ph.D., Professor of Plant Pathology

¹ On leave of absence, 1920-21.

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 HALLY J. FISHER, R.N., Instructor in Home Nursing

¹ On leave of absence 1920-21.

- WILLIAM K. FOSTER, LL.M., Assistant Director of Gymnasium
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 JOHN W. BUSHNELL, B.S. in Agr., Assistant in Horticulture
 CHESTER DAHLE, Assistant in Dairy Husbandry

FRANK GILMAN, Assistant in Physical Education for Men
 HARRY GOLDIE, Assistant in Physical Education for Men.
 OTTO G. SCHAEFER, B.S. in Agr., Assistant in Dairy Husbandry
 WILLIAM T. TAPLEY, B.S., Assistant in Horticulture

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ELMER J. LUND, Ph.D., Associate Professor of Zoology

¹ On leave of absence 1920-21.

² Resigned July 1, 1920.

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¹On leave of absence 1920-21.

CHARLES E. LIVELY, M.A., Instructor in Sociology
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 ANDREW N. WRAY, Teaching Fellow in Sociology

FACULTY COMMITTEES

1920-1921

Executive.—The Executive Committee of the Department of Agriculture

Enrollment.—WEST, BIESTER, MORROW, PIERCE, WENTLING

Curriculum.—FREEMAN, BIESTER, BOSS, CHEYNEY, FITCH, RILEY, STORM,
 WEIGLEY, WELLER, WEST

Students' Work.—FREEMAN, CHEYNEY, Mrs. LADD, NICHOLSON, WEIGLEY,
 WEST

Student Organizations.—LANSING, DUTCHER, FREEMAN, MORSE, WELLER

Farm Experience.—BOSS, ALDERMAN, ECKLES

Faculty Business.—GORTNER, RUGGLES, STAKMAN, PHELPS

GENERAL INFORMATION

ADMISSION

New students are admitted at the opening of any quarter.

All students entering for the first time must submit their credentials to the Enrollment Committee.

Admission is either by certificate or by examination. Candidates must have completed the equivalent of a four-year high-school course and must present:

1. Four units of English; or three units of English and four units of a foreign language; or three units of English and two units in each of two foreign languages.
2. One unit of elementary algebra and one unit of plane geometry.
3. Enough additional work to make in all fifteen units, of which not more than four may be in subjects not listed in the admission groups in the general information bulletin.

Graduates of the School of Agriculture of the University of Minnesota who have completed the two summers of supervised work offered in the school course, one additional school year, and one additional summer's work, or the equivalent thereof, will be admitted to the College of Agriculture, Forestry, and Home Economics.

For details of admission requirements and definition of "unit," see the bulletin of general information.

Every prospective student is urged to obtain before entering college at least six months' practical experience on a farm. Entering students whose farm experience credentials are not satisfactory will be examined as to their familiarity with farm practices, and farm experience will be required during the college course in accordance with the results of these examinations. For students who major in dairy husbandry at least three of the six months of approved farm experience must be on an accredited dairy farm.

Applicants for admission are urged to present physics (1 unit), chemistry (1 unit), and higher algebra ($\frac{1}{2}$ unit), for entrance credits. If these subjects are not completed in the high school, they will have to be taken in the University, thus postponing some of the vocational courses.

FEES

Free tuition.—The state will pay the tuition of any student who served in the army, navy, or marine corps of the United States during any war in which the United States has been involved, including members of the national guard or who, upon the call of the president, performed military service outside the borders of Minnesota in any trouble with Mexico; and of any student who performed overseas service as a regularly enlisted full-time worker of the Red Cross, engaged in nursing the sick or assisting in the care of soldiers in any government hospital, field or camp, which service has been officially recognized by the national government. The

amount of this free tuition is not to exceed \$200 for any one person and the benefits of this act will not extend beyond July 1, 1924. The amount to be paid in any year will be limited by the legislative appropriation for that year.

Any amount applied for as bonus under the State Bonus Law is deducted from the \$200 available for tuition.

Application for this free tuition should be made to the secretary's office at the time of registration. This applies only to students, who at the time of enlistment were citizens and residents of the state of Minnesota.

Tuition includes all of the regular quarter charges listed below except the deposit and penalty fees for change of registration, late registration, condition examinations, etc.

Tuition fee (per quarter)

Residents of Minnesota.....	\$20.00
Non-residents	30.00
Deposit (first quarter only).....	5.00
Health fee (per quarter).....	2.00
Minnesota Union (per quarter).....	.70
Post-office box (per quarter).....	.20
Special fees	
Examination for removal of conditions.....	1.00
Examinations for credit (after the first quarter in residence).....	5.00
Special examinations	5.00
Change of registration	2.50

Late registration.—Old students must indicate their registration not later than two weeks before the day set for classes to begin. All students must complete their registration (including payment of fees) before the day set for classes to begin. Penalty for delay in either indicating or completing registration is five dollars. An additional dollar is charged for each day of delay after the last day set for the completion of registration and a similar charge is made for each day of delay after the last day set for payment of fees.

Important.—The regulations require that no student be allowed to register after the quarter opens except by special committee action.

FACULTY REGULATIONS

Students are held responsible for compliance with all faculty regulations. These regulations are published in a booklet issued to students at the time of registration.

REQUIREMENTS FOR GRADUATION AND DEGREES

After the completion of the prescribed course of study, including all of the required work and the requisite amount of elective work equivalent to a total of 204 (210, in June, 1921) credit hours, candidates will be recommended for graduation with the degree of Bachelor of Science.

CANDIDATES FOR THE TEACHER'S CERTIFICATE IN AGRICULTURE AND HOME ECONOMICS

Candidates for the teacher's certificate during the year 1920-21 will remain registered in the College of Agriculture, Forestry, and Home Economics.

The University desires, by encouraging the entrance of men and women into the profession of teaching, to emphasize the building up of a professional teaching spirit in its student body. Beginning with the year 1921-22 the University teacher's certificate will be granted only to graduates of the College of Education. Graduates of the College of Agriculture, Forestry, and Home Economics who have complied with the state requirements as to educational subjects may apply to the State Department of Education for special certificates (or first-grade certificates if the candidate has had one year of successful teaching experience) in agriculture and home economics. This method of obtaining certificates will be available only as long as the State Department of Education feels that such certificates must be issued to meet the emergency in education and to comply with existing laws.

COURSE OF STUDY IN AGRICULTURE

The course of study is made up of 204* credit hours of work including:

1. Required courses, 105 to 128 credit hours, which every student must complete. These constitute approximately half of the curriculum and are considered as fundamental to any course in agriculture. In most cases these will be completed in the freshman and sophomore years.

2. Elective courses, 76 to 99 credit hours, distributed as follows:

a. A major of from 24 to 36 credit hours.

b. A minor of 18 credit hours.

c. Limited electives amounting to 50 per cent of the remaining number of credit hours, which must be selected outside of the groups from which the major and minor have been chosen, and

d. Free electives, sufficient to meet the number of credit hours required for graduation chosen from any of the courses offered in the University.

The major and minor must be selected from different elective groups, except that students whose major is chosen from group 4 (see page 20), Agricultural Sciences and Plant Industry, may select their minor from a different field of work in the same group.

EXPLANATION OF TERMS AND COURSE NUMBERS

The quarters in which courses are offered are indicated by the letters f (fall), w (winter), s (spring), and su (summer) following the course number. For example: 5f,w,s indicates that Course 5 is given in the fall quarter and is repeated in the winter and again in the spring quarter; 5f-6w indicates a two-quarter course extending through the fall and winter quarters; and 5f,w-6w,s, indicates that Course 5-6 is given in the fall and winter quarters and repeated through the winter and spring quarters.

All undergraduate courses are numbered from 1 to 100. All courses open to undergraduates and graduates are numbered from 101 to 200.

Numbers following the descriptive name of a course indicate the number of credit hours.

Course numbers in parentheses, following the number of credit hours, indicate prerequisite courses.

Descriptions of the courses listed in the following outline of the curricula, together with those of additional courses offered as electives, will be found on pages 23 to 76. The divisional statements are arranged alphabetically according to the names of the divisions.

* Students graduating in June, 1921 will be required to complete 210 credit hours, and those graduating in June, 1922, 207 credit hours, for their degrees.

One *credit hour* is equivalent to (1) one lecture or recitation period requiring two hours of preparation, (2) two periods of laboratory work requiring one hour of preparation, or (3) three periods of laboratory work with no preparation, each week for one quarter.

A *major* is a series of courses equivalent to from 24 to 36 credit hours chosen from one of the elective groups.

A *minor* is a series of courses equivalent to 18 credit hours chosen from one of the elective groups.

A *required* course is a course required of all students for graduation, irrespective of their major sequence.

A *limited elective* course is an elective which may not be chosen from the same group as the major or minor.

A *free elective* course may be chosen from any courses offered in the University for which the student has completed the prerequisites.

REQUIRED COURSES

All of the following work is required of every student except for the exemptions indicated. For some students this represents more than the regular amount of work of 17 credit hours per quarter. In such cases those subjects listed below which can not be taken in the freshman and sophomore years must take precedence the following year. Registration for from 15 to 18 credit hours of work each quarter will be allowed without special permission. Care should be taken in registration to give precedence to courses offered only one quarter.

1. *Non-credit courses* required for graduation in addition to the 204 credit hours.

Freshman lectures. A course of nine lectures intended primarily to familiarize the new student with the college, college customs, and methods of procedure. Offered only in the fall quarter. Must be taken in the freshman year.

Military drill. Three hours per week throughout the freshman and sophomore years. Students found to be physically unfit may be required to substitute special corrective exercises in gymnasium.

Physical Education 3w. Gymnasium and Swimming. Two hours per week for one quarter. Must be taken in the freshman year.

2. *General courses*.—The following courses may be registered for any quarter that they are offered except that the proper sequence of continuation courses and the prerequisites must be observed. Ordinarily, if botany is registered for in the freshman year, registration for zoology should be postponed until the sophomore year, and vice versa.

Agr. Biochem. 7f,w-8w,s, General Agricultural Biochemistry, 10 (Chem. 1-2-3 or 9-10)

Agron. 1f,w,s,su, Farm Crops, 3 (Soils 2)

An. Biol. 1f,w,s-2w,s,su, General Zoology, 10.

An. Husb. 1f,w, Types and Breeds of Livestock, 5.

Bact. 1f,w,s,su, Elementary Bacteriology, 5 (Chem. 1-2-3 or 9-10 Biol. 1 yr.)

Bot. 1f,s-2w,f, General Botany, 10. Students entering college with a year of high-school botany satisfactory to the department may omit Bot. 1 (see footnote on page 38) and substitute 5 credits elective later in their course of study.

Chem. 1f-2w-3s, General Inorganic Chemistry, 12. Students presenting a year of high-school chemistry may omit this course and register for Chem. 9-10. Those required to take this course because of inability to carry successfully Chem. 9-10 will be allowed not more than 10 credits.

Chem. 9f-10w, Advanced General Inorganic Chemistry, 10. Those required to take Chem. 1-2-3 are exempt.

- Dy. Husb. 1f,w,s, Elements of Dairying, 5.
 Econ. 5f,w, General Economics, 5. Not open to freshmen.
 Econ. 6f,w,s, Agricultural Economics, 3 (Econ. 5)
 Farm Eng. 3f,s, Mechanical Drawing, 3.
 Farm Eng. 8f,w, Farm Engineering, 5.
 Farm Eng. 11f,w, Applied Mathematics, 5. Students presenting a half-year of high-school higher algebra may omit this course and substitute 5 credits elective later in their course of study.
 Farm Eng. 21f-22w, Agricultural Physics, 10. Those presenting a year of high-school physics may omit this course and substitute 10 credits elective later in their course of study.
 For. 26f,w, Tree Crops, 1. Should be taken in freshman year parallel with Soils 2.
 Hort. 90f,s, General Horticulture, 3 (Soils 2)
 Phys. Educ. 1f,w,s, Personal Hygiene, 1.
 Pol. Sci. 1f, American Government, 5 (Not open to freshmen)
 Rhet. 1f,w,s, ¹Rhetoric I, 3.
 Rhet. 2f,w,s, Rhetoric II, 3 (Rhet. 1)
 Rhet. 3f,w,s, Rhetoric III, 3 (Rhet. 2)
 Rhet. 4f,w,s, Elementary Rhetoric, 3. Required only of those who are found to be unable to carry Rhet. 1.
 Rhet. 11f,w,s, Argumentation, 5 (Rhet. 3)
 Rhet. 22f,w,s, Public Speaking, 5 (Rhet. 3)
 Soils 2f,w, Elementary Soils, 2.
 Soils 3s, Soils, 3 (Chem. 1-2-3 or 9-10, Soils 1)

ELECTIVE GROUPS

A. Groups from which major, minor, or electives may be chosen.

1. Agricultural Economics and Farm Management, including
 Agricultural Economics
 Farm Management
2. Agricultural Education and Agricultural Extension, including
 Agricultural Education
 Agricultural Extension
3. Animal Industry, including
 Animal Husbandry
 Dairy Husbandry
 Poultry Husbandry
 Veterinary Medicine
4. Agricultural Sciences and Plant Industry, including
 Agricultural Biochemistry
 Agronomy
 Entomology and Economic Zoology
 Horticulture
 Plant Pathology and Botany
 Soils

B. Group from which minor or electives may be chosen

1. Farm Engineering, including
 Farm Engineering
 Agron. 3, Farm Machinery

C. Groups from which electives only may be chosen

1. Bee Culture
2. Forestry
3. Home Economics
4. Military Science and Tactics
5. Physical Education
6. Rural Publications and Journalism
7. Courses in departments of other schools and colleges of the University

¹ Special attention is called to rules on delayed credit and to regulations for students with insufficient preparation in English on page 71.

ELECTIVES

Students should consult with their advisers with reference to their choice of limited and free electives.

In selecting electives, note particularly (a) prerequisites, (b) classes of students (fr., soph., jr., or sr.) to which courses are offered, (c) number of credits, (d) quarter or quarters offered, and be sure that provision is made in registration for the proper sequence of continuation courses.

Registration for courses as electives in other colleges of the University must be in conformity with regulations of the college offering the course.

Elective courses in the College of Science, Literature, and the Arts, are separated into Junior College courses, open to freshmen and sophomores, and Senior College courses, open to juniors and seniors. In addition to satisfying other prerequisites an average grade of C must be maintained for the first two years in order to register for a Senior College elective.

AGRICULTURE-BUSINESS COURSE

This course offers an opportunity for those who wish to prepare specifically for some branch of agricultural business, such as the marketing of farm products, farm finance, farm implements, farm real estate, country merchandising and the like. The first two years are practically prescribed and include introductory courses in agriculture, economics, and the fundamental sciences necessary for further work in agriculture. During the freshman and sophomore years, students will register in the College of Agriculture, Forestry, and Home Economics. The junior and senior years are offered in the School of Business. Approximately half of the last two years is elective and may include advanced courses in agriculture and economics.

FRESHMAN AND SOPHOMORE YEARS

The outline for these years is the same as for the course in Agriculture (see pages 19 to 20) except that the following courses are omitted:

Agr. Biochemistry 7f,w-8w,s, General Agricultural Biochemistry, 10
 Bact. 1f,w,s,su, Elementary Bacteriology, 5
 Farm Eng. 3f,s, Mechanical Drawing, 3
 Farm Eng. 11f,w, Applied Mathematics, 5
 Farm Eng. 21f-22w, Agricultural Physics, 10
 Rhet. 11f,w,s, Argumentation, 5
 Rhet. 22f,w,s, Public Speaking, 5
 Soils 3, Soils, 3
 Pol. Sci. 1f, American Government, 5

The following courses are added:

Econ. 20w-21s, Economic History and Geography of Agriculture, 10 (must be taken in the freshman year)

Econ. 25f-26w, Principles of Accounting, 8 (not open to freshmen)

Econ. 23w, Business Organization, 5 (Econ. 3-4, or 5, or 7. Not open to freshmen)

Econ. 13s, Agricultural Statistics, 5 (Econ. 3-4, or 5, or 7. Not open to freshmen)

Electives, 2 to be selected from the courses omitted from the first two years of the Agriculture course.

COURSES IN AGRICULTURE

The courses dealing with agricultural business which are offered by the School of Business and the College of Agriculture during the last two years are arranged by the School of Business into two lines of specialization as follows:

GENERAL COURSE

JUNIOR YEAR

Fall Quarter

No.	Title	Credits
Econ. 143f-144w	Money and Banking.....	5
Econ. 18f	Problems in Agricultural Economics.....	3
Econ. 89f	Marketing of Agricultural Products.....	5
	Electives	1-4

Winter Quarter

Econ. 143f-144w	Money and Banking.....	5
Agron. 102w	Farm Management II.....	3
	Electives	5-9

Spring Quarter

Pol. Sci. 28s	Business Law.....	5
Econ. 150s	Farm Finance.....	3
Agron. 103s	Farm Management II.....	3
	Electives	3-6

SENIOR YEAR

Fall Quarter

Econ. 107f	Land Economics.....	5
	Electives	9-12

Winter Quarter

Econ. 46w	Economics of Agricultural Production.....	3
Econ. 73w	Railway Traffic and Rates.....	3
	Electives	8-11

Spring Quarter

Econ. 117s	Prices of Farm Products.....	3
	Electives	11-14

Recommended electives:

Advanced courses in technical agriculture

Econ. 85f-86w	Marketing of Manufactured Products.....	6
Econ. 88s	Advertising	3
Econ. 103f-104w	Value and Distribution.....	6
Econ. 109w	Economics of Consumption.....	3
Econ. 176f	Commercial Policies	3
Econ. 177w	Foreign Trade.....	3
Econ. 191f-192w	Public Finance.....	6
Econ. 54s	Corporation Finance.....	3
Econ. 146w	Investments	3

MARKETING OF FARM PRODUCTS

JUNIOR YEAR

Fall Quarter

No.	Title	Credits
Econ. 89f	Marketing of Agricultural Products.....	5
Econ. 85f-86w	Marketing of Manufactured Products.....	3
Econ. 18f	Problems in Agricultural Economics.....	3
	Electives	4-7

Winter Quarter

Econ. 73w	Railway Traffic and Rates.....	3
Econ. 85f-86w	Marketing of Manufactured Products.....	3
	Electives	8-11

Spring Quarter

Econ. 88s	Advertising	3
Econ. 110s-111f	Practice Course in Marketing.....	1
	Electives	10-13

SENIOR YEAR

Fall Quarter

Econ. 143f-144w	Money and Banking.....	5
Econ. 110s-111f	Practice Course in Marketing.....	2
	Electives	8-12

Winter Quarter

Econ. 143f-144w	Money and Banking.....	5
Econ. 108w	Agricultural Marketing Problems.....	3
	Electives	6-9

Spring Quarter

Pol. Sci. 28s	Business Law.....	5
Econ. 117s	Prices of Farm Products.....	3
	Electives	6-9

Recommended electives:

Advanced courses in technical agriculture dealing with special products.

Econ. 54s	Corporation Finance.....	3
Econ. 150s	Farm Finance.....	3
Econ. 72f	Economics of Transportation.....	3
Econ. 145s	International Exchange.....	3
Econ. 177w	Foreign Trade.....	3
Econ. 176f	Commercial Policies.....	3
Econ. 107f	Land Economics	5
Econ. 116w	Economics of Agricultural Production.....	3
Geol. 37s	Economic Geology.....	3

DESCRIPTION OF COURSES

For explanation of course numbers and credits see page 18.

AGRICULTURAL BIOCHEMISTRY

Professors ROSS A. GORTNER, CLYDE H. BAILEY; Associate Professors R. ADAMS DUTCHER, LEROY S. PALMER; Assistant Professors GEORGE E. HOLM, CLARENCE A. MORROW, JOHN J. WILLAMAN; Instructors CORNELIA KENNEDY, PAUL F. SHARP.

General statement.—This division offers two types of work, namely, courses in those phases of chemistry which have special application in agriculture or home economics for students whose major work is in other divisions; and courses designed to train chemists for research or instruction in the special field of agricultural biochemistry.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
2w	Quantitative Methods.....	5	Jr., sr.	Chem. 10. cred.
3f,w,su	Types of Carbon Compounds.	6	Soph., jr.,sr.	Chem. 10 cred.
7f,w-8w,s	General Agricultural Biochemistry	10	Soph., jr., sr.	Chem. 10 cred.
15f	Principles of Animal Nutrition	3	Jr., sr.	7-8
<i>Advanced Courses</i>				
101f,su- 102w,su	Agricultural Quantitative Analysis	6	Jr., sr.	7-8
103f,su ¹	Dairy Chemistry.....	5	Jr., sr.	7-8
106f	Chemical Technology of Agricultural Products....	5	Sr.	101-102
108s,su ¹	Chemistry of Wheat and Wheat Products... ..	3	Jr., sr.	7-8
110s,su ¹	Flour Laboratory Methods..	5	Jr., sr.	101-102, or Chem. 131-132, parallel 108
111f,su- 112w,su	Phytochemistry	6	Sr.	Biol. 10 cred., org. chem.
113f,su- 114w,su	Biochemical Laboratory Methods	4	Sr.	Quant. anal., parallel 111-112
116f,w,s,su	Chemistry of "Vitamines" and Deficiency Diseases.....	3 or 5	Sr.	111-112, 113-114, or Physiol. 101-102, or 7-8 and 15
118f,w,s,su	Laboratory Problems in Biochemistry	3 or 5	Sr.	111-112, 113-114; or 103 or 110

¹ Offered in alternate summers, offered in 1921.

INTRODUCTORY COURSES

- 2w. QUANTITATIVE METHODS. A brief course in the principles of quantitative analysis, including a study of stoichiometric problems, practice in the use of the balance and in typical gravimetric and volumetric manipulations. WILLAMAN.
- 3f,w,su. TYPES OF CARBON COMPOUNDS. An elementary study of the different groups of carbon compounds, with special reference to their relationships and their occurrence in plant and animal materials used as food. MORROW.
- 7f,w-8w,s. GENERAL AGRICULTURAL BIOCHEMISTRY. A lecture and laboratory course involving a qualitative and quantitative study of the types of organic and inorganic compounds found in plants and animals and of the chemical changes involved in metabolism, growth, and maintenance. DUTCHER.
- 15f. PRINCIPLES OF ANIMAL NUTRITION. A course consisting of lectures, recitations, and collateral reading emphasizing the chemical and physiological principles underlying digestion, metabolism, utilization of feeds, maintenance, growth, fattening, milk production, vitamin hypothesis, and deficiency diseases. DUTCHER.

ADVANCED COURSES

- 101f,su-102w,su. AGRICULTURAL QUANTITATIVE ANALYSIS. The estimation of inorganic and organic constituents of biological products, the proximate analysis of foods and feeding stuffs, the use of the polariscope, immersion refractometer, colorimeter and nephelometer, viscosimeter, and other special apparatus. MORROW.
- 103f,su. DAIRY CHEMISTRY. Lectures, library, and laboratory work involving a study of the chemical composition of dairy products and the quantitative analysis of these products as practiced in control laboratories, together with qualitative examination for preservatives and adulterations. PALMER.
- 106f. CHEMICAL TECHNOLOGY OF AGRICULTURAL PRODUCTS. The composition of the principal products and by-products of agriculture and their utilization as raw material in various industries, and the methods of chemical control work in these industries. BAILEY.
- 108s,su.¹ CHEMISTRY OF WHEAT AND WHEAT PRODUCTS. A lecture course, with collateral library reference work, on the chemical technology of the production and milling of wheat and the conversion of its products into human food. BAILEY.

¹ Offered in alternate summers, offered in 1921.

- 110S,su.¹ FLOUR LABORATORY METHODS. A laboratory course in methods of analysis of wheat and its products; milling tests of wheat, baking and special tests of flour. Designed to train students for research and control work in the cereal industry. BAILEY.
- 111f,su-112W,su. PHYTOCHEMISTRY. Advanced course dealing with the colloidal state, and the chemistry of proteins, carbohydrates, glucosides, tannins, fats, plant acids, enzymes, and pigments and their physico-chemical relations to the vital processes involved in growth and nutrition. MORROW.
- 113f,su-114W,su. BIOCHEMICAL LABORATORY METHODS. A laboratory course paralleling the lectures in 111, using recent methods for the investigation of biologically important compounds, with especial reference to the detection and estimation of such compounds in cells or tissues. MORROW, SHARP.
- 116f,w,s,su. THE CHEMISTRY OF "VITAMINES" AND DEFICIENCY DISEASES. Lectures, consultations, and library work on special nutritional problems accompanied by chemical and biological studies of food materials from the standpoint of their "vitamine" content. DUTCHER, KENNEDY.
- 118f,w,s,su. LABORATORY PROBLEMS IN BIOCHEMISTRY. Special laboratory work in the preparation and isolation of pure compounds which occur in living cells, the study of biochemical reactions, and special methods of identification or determination of biochemical products. GORTNER, BAILEY, DUTCHER, PALMER, HOLM, MORROW, WILLAMAN.

AGRICULTURAL ECONOMICS

See Economics (page 43).

AGRICULTURAL EDUCATION

Professors ASHLEY V. STORM, DEXTER D. MAYNE; Assistant Professors JOHN V. ANKENY, WILLIAM P. DYER, ALBERT M. FIELD; Extension Specialists THEODORE A. ERICKSON, GEORGE F. HOWARD.

AGRICULTURAL EXTENSION

Instructor SPENCER B. CLELAND.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
11f,s	Principles of Vocational Education	3	Jr., sr ²	None
21f,w	Vocational Education	3	Jr., sr ²	None
41f,w,s	Teaching I	2	Jr., sr ^{2 3}	11, 131
42f,w,s	Teaching II	3	Sr. ^{2 3}	41, 131, Agron. 121, 122, 123

¹ Offered in alternate summers, offered in 1921.

DESCRIPTION OF COURSES

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No.	Title	Credits	Offered to	Prerequisite courses
53f,su	Consolidated Rural Schools..	3	All ²	None
54s,su	Rural Education and Community Life.....	3	All	None
63f-64w-65s	General Agriculture.....	9	All	None

Advanced Courses

74f,su ⁴	Visual Presentation.....	2	Jr., sr	None
75w,s	Visual Presentation.....	3	Jr., sr.	None
121w	Teachers' Course Home and School Garden Supervision	2	Approval of	division
131w,s,su	Methods in Teaching High-School Agriculture.....	5	Jr., ¹ sr, ²	11
132s,su ³	Methods in Teaching High-School Agriculture.....	3	Jr., sr.	11
133f,w,s	Organization and Methods for Manual Training....	3	Jr., sr.	11
151f,s	Organization and Management	5	Sr., ²	11, 12
161f-162w-163s	Fundamentals of Agriculture	9	Jr., sr. ²	None
164w,su ⁴	Fundamentals of Agriculture	3	Jr., sr. ²	None
171f,w	Extension Work.....	3	Sr.	None
173f,w,s	History of Agriculture.....	3	Soph., jr., sr.	None
176s	Advanced Visual Presentation	3	Jr., sr.	175
181w	Agricultural Statistics and Graphic Representation....	3	Soph., jr., sr.	None
191f-192w-193s	Seminar in Agricultural Education	2-6	Sr. ²	None

AGRICULTURAL EXTENSION

1s	Agricultural Extension.....	2-3	Jr., sr.	12 cred. farm mgt. and agr. econ., 15 cred. an. industry; 6 cred. agr. educ.
2su,f	Agricultural Extension Field Course	3-12	Jr., sr.	1, approval of Agr. Ext. Division. An approved position

¹ Open to juniors on approval of the chief of the division.² Offered only to those preparing to teach.³ Students are admitted to this course only when recommended by the faculty of the group in which they are majoring and when accepted by the Division of Agricultural Education.

Students who are prepared may be required to do their teaching in manual training.

⁴ Special reduced courses for consolidated-school principals.

INTRODUCTORY COURSES

11f,s. PRINCIPLES OF VOCATIONAL EDUCATION. The fundamental principles upon which education is based. Emphasis is placed on those phases which are most closely related to vocational education. DYER.

- 21f,w. VOCATIONAL EDUCATION. A short history of vocational education; present status in Europe and the United States; manual training, and home arts in an educational system; place of agriculture in the public schools with special reference to Minnesota. MAYNE.
- 41f,w,s. TEACHING I. An introductory course in teaching, including observation of class work, apprentice teaching, and special conference discussions of problems relating to teaching. Intended to initiate the student into the routine of classroom procedure. Professional readings. ANKENY, DYER, FIELD.
- 42f,w,s. TEACHING II. Preparation of lesson plans and actual teaching of classes under careful supervision in recitation and laboratory; criticism and discussion of plans, methods and results of students teaching. Review and discussion of assigned professional readings. ANKENY, DYER, FIELD.
- 53f,su. CONSOLIDATED RURAL SCHOOLS. Building arrangements, selection of teachers, equipment, transportation of pupils, health supervision, home project work, and other problems in organization and management of consolidated rural schools from the viewpoint of the special needs of rural life. DYER.
- 54s,su. RURAL EDUCATION AND COMMUNITY LIFE. Special attention given to features which are desirable in a rural community for educational, recreational, ethical, and esthetic purposes and the ways and means to organize the same about the school as a center. DYER.
- 63f-64w-65s. GENERAL AGRICULTURE. For students majoring in such fields of work as agricultural biochemistry, entomology, and economic zoology, plant pathology, and in other colleges. A series of units by division chiefs and other agricultural specialists. STORM, MAYNE.
- 74f,su. VISUAL PRESENTATION. To acquaint students with the various visual aids, their preparation, source and use in the teaching process. Actual laboratory practice is given in the preparation and operation of various mediums. ANKENY.
- 75w,s. VISUAL PRESENTATION. To prepare persons for presenting materials by means of slides, films, charts, etc. Students assisted in assembling materials for their own use and in acquiring skill and technique in preparation and operation of various mediums. ANKENY.

ADVANCED COURSES

- 121w. TEACHERS' COURSE HOME AND SCHOOL GARDENING. A lecture and laboratory course designed to give teachers the preparation necessary for the proper planning, management, supervision of home and school gardens. ANKENY, FIELD.

- 131w,s,su. METHODS IN TEACHING HIGH-SCHOOL AGRICULTURE. Fundamental elements of method in teaching as related to teaching agriculture in high school. Organizing subject-matter of daily work; selection and manipulation of devices. Classroom and laboratory method. Specific plans for teaching secondary agriculture. FIELD.
- 132s,su. METHODS IN TEACHING AGRICULTURE. Fundamentals of method in teaching agriculture in public schools. Selecting, organizing, and presenting subject-matter. Equipment, illustrative material, laboratory work, field trips. Special emphasis on the home project as a method in teaching agriculture. FIELD.
- 133f,w,s. ORGANIZATION AND METHODS FOR MANUAL TRAINING.
- 151f,s. ORGANIZATION AND MANAGEMENT. Organization and management of work in secondary schools, particularly of Minnesota, with special reference to agricultural work, courses of study, programs, equipment, laboratory and class management, extension work, plots, and coordination of work. STORM, DYER.
- 161f-162w-163s. FUNDAMENTALS OF AGRICULTURE. Essential for principals and superintendents of schools in which agriculture is taught, and valuable for students of other colleges whose time for agriculture is limited. Agricultural College experts will give work in their special fields. STORM.
- 164w,su. FUNDAMENTALS OF AGRICULTURE. Basic principles of agricultural science and the fundamental elements of practical agriculture. Special emphasis on concrete problems in soils, crops, and animal husbandry, as related to classroom instruction and to school and home projects. FIELD.
- 171f,w. EXTENSION WORK. Federal, state, and local extension aims, organization. Assembling and use of extension data and equipment. Development of extension methods especially as applied to the work in Minnesota. ———
- 173f,w,s. HISTORY OF AGRICULTURE. A history of agricultural progress with special reference to the greater movements and to sources from which modern agriculture has received its most valuable acquisitions. Comparisons of our own agriculture with that of other countries.
- 176s. ADVANCED VISUAL PRESENTATION. Continuation of 175. Further work in design and construction of charts and lantern slides. Special study of motion picture machines. Actual practice in effective use of visual aids in lecture and recitation. ANKENY.
- 181w. AGRICULTURAL STATISTICS AND GRAPHIC REPRESENTATION. Course teaches application of statistical methods to agriculture and different means of representing agricultural statistics graphically. Of value to all students to enable them to interpret, present, and use agricultural statistics and graphic representations. ———

191f-192w-193s. SEMINAR IN AGRICULTURAL EDUCATION. Critical studies of important problems in agricultural education; opportunity for individual investigation and research; review and interpretation of current educational literature. STORM, FIELD.

AGRICULTURAL EXTENSION

1s. AGRICULTURAL EXTENSION. History, financing, and methods of agricultural extension work. Administrative departments, specialists, county workers with special reference to Minnesota. Development and functions of the farm bureau. County programs and reports, office administration, demonstrations, organization work. CLELAND.

2su,f. AGRICULTURAL EXTENSION FIELD WORK. Actual field practice in extension work on part salary in addition to credits. Number admitted to course limited by positions available. Usually will cover summer quarter, may extend into fall quarter. CLELAND.

AGRONOMY AND FARM MANAGEMENT

Professors ANDREW BOSS, HERBERT K. HAYES, Associate Professors ALBERT C. ARNY, LOUIS B. BASSETT; Assistant Professors RALPH J. GARBER, FORREST W. MCGINNIS, GEORGE A. POND; Instructors FREDERICK H. STEINMETZ, CLINTON G. WORSHAM; Extension Specialists WILLIAM L. CAVERT, FRANKLIN C. CLAPP.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s,su	Farm Crops.....	3	All	Soils 2
11s	Farm Machinery.....	3	Jr., sr.	None
<i>Advanced Courses</i>				
101s	Farm Management I.....	3	Jr., sr.	1, Econ. 6
102f,w,su	Farm Management II: Organization	3	Sr.	1, Econ. 6, An. Husb. 6 or 8, Soils 3
103w,s	Farm Management II: Operation	3	Sr.	102
104s	Farm Management III.....	3	Sr.	101, 102
121f	Cereal Crops.....	3	Jr., sr.	1, bot. 10 cred.
122w	Corn and Potato Crops.....	3	Jr., sr.	1, bot. 10 cred.
123s	Forage and Fiber Crops.....	3	Jr., sr.	1, bot. 10 cred.
131f	Principles of Genetics.....	3	Jr., sr.	Bot. 10 cred., an. biol. 10 cred.
132s,su	Farm Crops Plant-Breeding.	3	Jr., sr.	131

INTRODUCTORY COURSES

1f,w,s,su. FARM CROPS. An elementary study of the important field crops of the United States with emphasis upon those of local importance; distribution, economic importance, agricultural classification, cultural methods, and principles of improvement. GARBER, MCGINNIS, STEINMETZ.

- 11s. FARM MACHINERY. Lectures and laboratory work covering classification, mechanical construction, adjustment, and operation of the different kinds of farm machinery. BASSETT.

ADVANCED COURSES

- 101s. FARM MANAGEMENT I. Farm records—a study of simple farm accounting and of the forms and methods employed in making cost of production studies, and farm management surveys. Practice given in the art of record-keeping and accounting. POND, WORSHAM.
- 102f,w,su. FARM MANAGEMENT II: ORGANIZATION. A course in which the business side of farming is emphasized. Special attention is given to farm organization and equipment. BOSS, POND.
- 103w,s. FARM MANAGEMENT II: OPERATION. Continuation of 102. Special attention is given to farm operation. BOSS, POND.
- 104s. FARM MANAGEMENT III. An advanced seminar course, including cost of production studies, farm business analyses, and farm practices. BOSS.
- 121f. CEREAL CROPS. An advanced study of the cereal crops. Structure, group classification, improvement, growing, and utilization. Brief score-card practice and a limited amount of placing on intrinsic value included. ARNY, MCGINNIS.
- 122w. CORN AND POTATO CROPS. A study of the corn and potato crops similar to that outlined for Course 121. ARNY, MCGINNIS.
- 123s. FORAGE AND FIBRE CROPS. A study of forage plants through assigned reading, laboratory and field work. Following the study of each crop some attention is given to score-card practice and comparative placing of representative samples. ARNY, MCGINNIS.
- 131f. PRINCIPLES OF GENETICS. Lectures and laboratory work designed to familiarize the student with the underlying principles of breeding. Heredity variation, biometry, and evolution are emphasized. Same as Hort. 109. HAYES, DORSEY.
- 132s,su. FARM CROPS PLANT-BREEDING. Applied genetics is emphasized. Methods of breeding each of the important agricultural and horticultural crops with special attention to experiment station investigations and to the methods used by plant breeders. HAYES, GARBER.

ANIMAL BIOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors HENRY F. NACHTRIEB, HAL DOWNEY, WILLIAM A. RILEY, THOMAS S. ROBERTS, CHARLES P. SIGERFOOS; Associate Professor ELMER J. LUND; Assistant Professors ROYAL N. CHAPMAN, OSCAR W. OESTLUND; Instructor ADOLPH RINGOEN.

General statement.—Courses in this department are closely correlated with those offered by the Division of Entomology and Economic Zoology of the College of Agriculture, Forestry, and Home Economics. For courses of that division, see page 50.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s-2w,s,su	General Zoology.....	10 ¹	All	None
9f-10w	Histology	10 ¹	Soph., jr., sr.	1-2
11s	General Histology.....	5	All	1-2
17f-18w	General Physiology.....	10 ¹	Soph., jr., sr.	15 cred. or 10 cred. and chem. or phys. 10 cred.
23s	Morphogenesis and Behavior of Organisms.....	5	All	15 cred. or 10 cred. and chem. or phys. 10 cred.
35s	General Embryology.....	5	All	1-2
37f-38w-39s	General Entomology.....	9 ¹	Soph., jr., sr.	1-2
43s	Introductory Entomology....	5	All	1-2
44f	Animal Parasites.....	5	Soph., jr., sr.	1-2
59s	General Ecology.....	5	All	1-2
<i>Advanced Courses</i>				
107s	Protozoology	3	Jr., sr.	15 cred. incl. 1-2
109f-110w	General Physiology.....	10 ¹	Jr., sr.	20 cred.
114w-115s	Ornithology	6 ¹	Jr., sr.	1-2
117f-118w- 119s	Ecology of Insects.....	9 ¹	Jr., sr.	43
124su	Advanced Ecology.....	5	Jr., sr.	117-118-119
125f-126w- 127s	Advanced Entomology.....	9 ¹	Jr., sr.	37-38-39 or 43
130w	Biology and Taxonomy of the Aphididae	3	Jr., sr.	20 cred. incl. 1-2
139s-140w	Histology and Development of Insects.....	6 ¹	Jr., sr.	37-38-39 or 43
144f-145w- 146s	Animal Parasites and Para- sitism	9	Jr., sr.	1-2
181f-182w	Embryology	6	Soph., jr., sr.	1-2, 11 or 9-10
183s	Genetics and Eugenics.....	3	Jr., sr.	9-10

For additional courses, see the bulletin of the College of Science, Literature, and the Arts.

¹ The full course must be completed before credit will be allowed.

INTRODUCTORY COURSES

1f,w,s-2w,s,su. GENERAL ZOOLOGY. A survey of the animal kingdom, emphasizing the principles of development and structure in relation to functions and habit, heredity and evolution, and the animals of economic importance. Lectures, quizzes and laboratory. NACHTRIEB, SIGERFOOS, LUND, RINGOEN.

9f-110w. HISTOLOGY. A comparative microscopic study of the origin and structure of the tissues of vertebrates and invertebrates, and of the organs of mammals. Textbook, lectures, and laboratory. DOWNEY.

- 11s. GENERAL HISTOLOGY. A survey of the differentiation and specialization of the animal tissues and the construction of organs. Lectures, reference and laboratory work.
- 17f-18w. GENERAL PHYSIOLOGY. Physical and chemical properties of living protoplasm and cells. Various organisms are selected which show the nature of physiological processes and introduce the student to quantitative experimental methods in biology. Laboratory, lectures, and reading. LUND.
- 23s. MORPHOGENESIS AND THE BEHAVIOR OF ORGANISMS. Physiology of development of the egg. Regeneration. Production of heat, light, and electricity in animals. Comparative physiology of the nervous system, sense organs, and reactions in lower animals. Laboratory, lectures, and reading. LUND.
- 35s. GENERAL EMBRYOLOGY. A survey of general embryology and the organogeny of the vertebrates. Conference, reference, and laboratory work. NACHTRIEB.
- 37f-38w-39s. GENERAL ENTOMOLOGY. Elements of entomology leading up to discussion of the principles of taxonomy and their application to the classification of insects. OESTLUND.
- 43s. INTRODUCTORY ENTOMOLOGY. The structure, development, and classification of insects. An introductory course in entomology and preparatory for courses in economic entomology. OESTLUND.
- 44f. ANIMAL PARASITES AND PARASITISM. Lectures and laboratory work. A consideration of the origin and biological significance of parasitism, and the structure, life history, and economic relations of representative parasites. Methods of control and prevention will be emphasized. RILEY.
- 59s. GENERAL ECOLOGY. A general course covering the relationships of animals, animal societies, and faunas to the inorganic and organic factors of the environment. The course consists of lectures, assigned reading, recitations, laboratory and field work. CHAPMAN.

ADVANCED COURSES

- 107s. PROTOZOOLOGY. Lectures, reference and laboratory work on the structure and life histories of Protozoa, with special reference to the relation of the Protozoa to diseases of animals. SIGERFOOS.
- 109f-110w. GENERAL PHYSIOLOGY. A thoro survey of fundamental physiological processes in organisms. Based on Bayliss's *Principles of General Physiology*. Laboratory, lectures, and reading. LUND.

- 114W-115S. ORNITHOLOGY. Structure, classification, and habits of birds with special reference to the birds of Minnesota. Considerable time devoted to field study. Bird or field-glass and handbook required. Laboratory, lectures, and quizzes. Class limited to ten. ROBERTS.
- 117f-118W-119S. ECOLOGY OF INSECTS. General principles of ecology with special reference to the insects of Minnesota. Lectures, laboratory, assigned reading, and field work. CHAPMAN.
- 124su. ADVANCED ECOLOGY. Similar to 117-118-119 with special field work. CHAPMAN.
- 125f-126W-127S. ADVANCED ENTOMOLOGY. Advanced work in the lines of morphology and classification of insects, with lectures on the history of entomology. OESTLUND.
- 130W. BIOLOGY AND TAXONOMY OF THE APHIDIDAE. Intensive study of the natural history, bibliography, and classification of the Aphididae. OESTLUND.
- 139S-140W. HISTOLOGY AND DEVELOPMENT OF INSECTS. Lectures and laboratory work on the histology, embryonic and postembryonic development of insects. RILEY.
- 144f-145W-146S. ANIMAL PARASITES AND PARASITISM. Lectures and laboratory work. Origin and biological significance of parasitism, structure, life history, and economic relations of representative parasites. Second quarter devoted primarily to the relation of insects to disease of man and animals. RILEY.
- 181f-182W. EMBRYOLOGY. A survey of the principles of animal development and a detailed study of the development of the circulatory or urinogenital system of a vertebrate. Lectures, reference and laboratory work. NACHTRIEB.
- 183S. GENETICS AND EUGENICS. Facts and theories of heredity and the application of the laws governing natural inheritances for the improvement of the race. Lectures, references, quizzes, and demonstrations. NACHTRIEB.

ANIMAL HUSBANDRY

ANIMAL INDUSTRY GROUP

Professors CARL W. GAY, WALTER H. PETERS; Assistant Professor PHILIP A. ANDERSON; Instructors ARTHUR L. ANDERSON.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses*
<i>Introductory Courses</i>				
1f,w	Types and Breeds of Livestock	5	All	None
2f	Livestock-Judging	3	Soph., jr., sr.	1
3f-4w	Market Classes of Livestock.	6	Soph., jr., sr.	2
5w	Livestock-Breeding	3	Sr.	Vet. Med. 6, Agron. 131

No.	Title	Credits	Offered to	Prerequisite courses
6w	Livestock Feeding.....	5	Sr.	Agr. Biochem. 15
7f	Meats	3	Sr.	3, Agr. Biochem. 15
8s	Elements of Feeding.....	3	Jr., sr.	None
9s	Pedigrees and Herd Books..	3	Sr.	5

Advanced Courses

101f	Advanced Stock-Judging ...	3	Sr.	3-4
102s	Horse Husbandry.....	3	Sr.	3-4, 5, 6
103s	Beef Cattle Husbandry.....	3	Sr.	3-4, 5, 6
104s	Sheep Husbandry.....	3	Sr.	3-4, 5, 6
105s	Swine Husbandry.....	3	Sr.	3-4, 5, 6
106w	Advanced Meats.....	3	Sr.	7
107s	Meat Problems.....	3	Sr.	106
108s	Seminar	3	Sr.	5, 6

INTRODUCTORY COURSES

- 1f,w. TYPES AND BREEDS OF LIVESTOCK. The types as related to performance or production in horses, beef cattle, sheep, and swine, and the origin, history, characteristics, and economic importance of the breeds, classified according to type. GAY.
- 2f. LIVESTOCK-JUDGING. Practice in judging horses, cattle, sheep, and hogs from both the type and the breed standpoint. A. L. ANDERSON
- 3f-4w. MARKET CLASSES OF LIVESTOCK. Livestock markets and marketing methods. The market classes of horses, cattle, sheep, and swine. Practice in classifying, judging, and appraising livestock. ———
- 5w. LIVESTOCK BREEDING. The application of the principles of genetics to the breeding of livestock; a review of the master-breeders' methods and consideration of the practical breeders' problems. GAY.
- 6w. LIVESTOCK FEEDING. Feeding livestock under farm conditions; efficiency and economy in growing and fattening meat animals; feeding draft horses and colts. Consideration of experimental work and present practice. Practical feeding problems. Only three credits allowed to those who have completed Course 8. PETERS.
- 7f. MEATS. General course in the dressing of animals and the cutting of carcasses. Lectures and laboratory work. P. A. ANDERSON.
- 8s. ELEMENTS OF FEEDING. A general course giving a brief survey of livestock and dairy feeding designed for students not majoring in animal industry. Not open to those who have completed Course 6 or Dy. Husb. 103. PETERS, RAYBURN.
- 9s. PEDIGREES AND HERD BOOKS. Pedigree registration; laboratory practice in the use of the stud, herd, and flock records; tracing and tabulating pedigrees. ———

ADVANCED COURSES

- 101f. ADVANCED STOCK-JUDGING. Competitive judging of all types, breeds, and classes of livestock supplemented by visits to nearby stock farms. PETERS.
- 102s. HORSE HUSBANDRY. Stud-farm management; the selection of foundation stock and the breeding, feeding, and marketing of horses. Horse-power; factors determining a horse's efficiency for work. GAY.
- 103s. BEEF CATTLE HUSBANDRY. The management of pure-blood and grade herds; selection of foundation stock, sales, and shows, building equipment, labor. Practicums in fitting cattle for show and sale, animal photography, preparation of feeds, and the care of cattle. PETERS.
- 104s. SHEEP HUSBANDRY. The care and management of pure-bred sheep. Study of pedigrees, registrations, fitting for show purposes, marketing. Practicums in feeding, shearing, blocking, and caring for young lambs. P. A. ANDERSON.
- 105s. SWINE HUSBANDRY. Hog-farm equipment, pure-bred vs. market hogs; building a breeding herd, private herd records, herd management, fitting and showing, marketing breeding stock. Barn work and feeding practice. ———
- 106w. ADVANCED MEATS. Practice work in dressing animals and cutting carcasses giving particular attention to conformation as related to dressing percentage and the carcass; also a study of the physical and chemical composition of meat. P. A. ANDERSON.
- 107s. MEAT PROBLEMS. The wholesale cuts and grades of meat; the packing industry and the utilization of by-products. Special problems and trips to packing establishments. P. A. ANDERSON.
- 108s. SEMINAR. Special problems and review of investigations pertaining to the livestock industry. GAY.

BACTERIOLOGY AND IMMUNOLOGY

MEDICAL SCHOOL

Professor WINFORD P. LARSON; Assistant Professor ARTHUR T. HENRICI;
Instructor ANNE G. BENTON; Assistant ROBERT G. GREEN.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
1f,w,s,su	General Bacteriology.....	5	Soph., jr., sr.	Chem. 1 yr., biol. 1 yr.
103w	Special Bacteriology for Students of Agriculture..	4	Soph., jr., sr.	1

For additional courses see the bulletin of the Medical School.

INTRODUCTORY COURSES

1f,w,s,su. GENERAL BACTERIOLOGY. Lecture and laboratory course. The principles and technique of general bacteriology. Studies in the morphologic and biologic characters of the common bacteria. Preparation of culture media. Disinfectants and disinfection. Bacteriology of water and food products. LARSON, BENTON, GREEN.

103w. SPECIAL BACTERIOLOGY FOR STUDENTS OF AGRICULTURE. Bacteriology of the soil in relation to fertility; the nitrogen fixing bacteria of legumes; bacteria that cause plant diseases; bacterial diseases of domestic animals; the bacteriology of milk and dairying. HENRICI.

BEE CULTURE

Professor FRANCIS JAGER; Assistant Professor GROVER C. MATTHEWS.

General statement.—Theoretical and practical instruction on bees, honey, and wax production. At least one year of botany should be completed before electing these courses. General zoology and entomology are also desirable. If not already completed they should be taken at same time as the courses in bee culture.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
1s,su	Elements of Beekeeping I..	3	Jr., sr.	None
2f,w	Elements of Beekeeping II..	3	Jr., sr.	None
3w-4s	Advanced Beekeeping.....	6	Jr., sr.	1 or 2
5su	Queen-Raising	3	Jr., sr.	1 or 2

INTRODUCTORY COURSES

1s,su. ELEMENTS OF BEEKEEPING I. Fundamentals of bee behavior during the active season. Fundamentals of beekeeping practice during the active season. Modern equipment for beekeeping practice. Production of wax, comb, and extracted honey. JAGER.

2f,w. ELEMENTS OF BEEKEEPING II. Fundamentals of bee behavior outside of the active season. Preparations for wintering. Indoor and outdoor wintering. JAGER.

3w-4s. ADVANCED BEEKEEPING. Anatomy, psychology, instinct, and reflex action, architecture and geometry of the honey comb, chemistry of pollen and honey. Pollenization and honey flora of the state. Bee diseases in their relation to honey production. JAGER.

5su. QUEEN-RAISING. Queen-judging, principles of reproduction, grafting, drone-raising, mating. Nuclei, mailing, introducing requeening. In connection with University Farm queen bee raising station. JAGER, MATTHEWS.

BOTANY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors C. OTTO ROSENDAHL, ELIAS J. DURAND, LEE I. KNIGHT, JOSEPHINE E. TILDEN; Associate Professor FREDERIC K. BUTTERS; Assistant Professors WILLIAM S. COOPER, NED L. HUFF; Instructor ARTHUR M. JOHNSON.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,s-2w,f	General Botany.....	10 ¹	All	None
7s	Taxonomy of Flowering Plants	5	All	2
11f	Algae and Fungi.....	5	Soph., jr., sr.	2
15w	Anatomy of Vascular Plants.	5	Soph., jr., sr.	2
51f	Histological Methods.....	3	Jr., sr.	15 cred.
52f	Plant Physiology.....	5	Jr., sr.	15 cred.
53w	Botany of Economic Plants.	5	Jr., sr.	15 cred.
54s	Elementary Ecology.....	5	Jr., sr.	15 cred.
62w	Bryophytes and Pteridophytes	5	Jr., sr.	15 cred.
63s	Angiosperms and Gymnosperms	5	Jr., sr.	7 or 62
<i>Advanced Courses</i>				
105s	Algae	5	Jr., sr.	11
107w	Bryophytes	5	Jr., sr.	7, 62
108w	Pteridophytes	5	Jr., sr.	7, 62
110w	Gymnosperms	5	Jr., sr.	7, 63
113f-114w-				
115s	Advanced Taxonomy.....	9	Jr., sr.	7
118w-119s	Cytology	6	Jr., sr.	51
131f	Field Ecology.....	5	Sr.	54
133s	Forest Geography of North America	5	Sr.	54
141f	Advanced Plant Physiology I	5	Sr.	52, Org. Chem.
142w	Advanced Plant Physiology II	5	Sr.	52, Org. Chem.
143s	Advanced Plant Physiology III	5	Sr.	52, Org. Chem.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ Courses 2 must be completed before credit is allowed.

INTRODUCTORY COURSES

1f,s-2w,f. GENERAL BOTANY.¹ Fundamental principles of botany. Survey of organs of the flowering plant; its internal structure and physiology. Representatives of the algae, fungi, liverworts, etc., examined with special reference to tracing evolution of the vegetable kingdom. DURAND, BUTTERS, HUFF, JOHNSON.

¹ Students entering college with a year of high-school botany satisfactory to the department may be admitted directly to Course 2. All such must present to the department before registration, their high-school note-book and a statement from their teacher showing the amount and proficiency of their work.

- 7s. TAXONOMY OF FLOWERING PLANTS. A general study of the classification and relationships of flowering plants. Laboratory and field practice in the determination of species, together with lectures and quizzes. ROSENDAHL, JOHNSON.
- 11f. GENERAL MORPHOLOGY OF ALGAE AND FUNGI. A general survey of the structure, evolution, and classification of the algae and fungi. Lecture, laboratory, and field work. TILDEN.
- 15w. ANATOMY OF VASCULAR PLANTS. A study of the microscopic structure of vascular plants, the cell, tissues, and tissue systems with particular attention to the development and evolution of the vascular system in the root, stem, and leaf. BUTTERS.
- 51f. HISTOLOGICAL METHODS. Training in methods used in the preparation and preservation of class material. Special attention is given to methods of killing, imbedding, sectioning, staining, and mounting. DURAND.
- 52f. PLANT PHYSIOLOGY. An introductory course giving a general survey of plant functions. KNIGHT.
- 53w. BOTANY OF ECONOMIC PLANTS. A survey course treating the most important botanical features of the common plants. KNIGHT.
- 54s. ELEMENTARY ECOLOGY. An introduction to the study of plants and their environment; investigation of the habitat; its effects upon plants as individuals and in mass; plant communities; plant successions. Laboratory and field work, lectures, and discussion. COOPER.
- 62w. GENERAL MORPHOLOGY OF BRYOPHYTES AND PTERIDOPHYTES. A general survey of the structure, evolution, and classification of the liverworts, mosses, and ferns. HUFF.
- 63s. GENERAL MORPHOLOGY OF ANGIOSPERMS AND GYMNASPERMS. A general survey of the structure, evolution, and classification of seed plants. BUTTERS.

ADVANCED COURSES

- 105s. ALGAE. A study of freshwater forms, based on collections made by the class. Lectures, laboratory, and field work. TILDEN.
- 107w. MORPHOLOGY AND TAXONOMY OF THE BRYOPHYTES. A special study of the structure and classification of the liverworts and mosses. (Not offered in 1920-21.) DURAND.
- 108w. MORPHOLOGY AND TAXONOMY OF THE PTERIDOPHYTES. An intensive study of lycopods, ferns, and their allies, their structure and history, with special attention to the classification of living forms. Lectures, reference-reading, and laboratory work. BUTTERS.

- 110W. MORPHOLOGY AND TAXONOMY OF THE GYMNOSPERMS. An intensive study of cycads, conifers, and their allies, their structure and history, with special attention to the classification of living forms. Lectures, reference-reading, and laboratory work. BUTTERS.
- 113f-114W-115S. ADVANCED TAXONOMY. An advanced course in which special attention is given to the taxonomy of difficult natural groups, involving systematic principles and practice, rules of nomenclature, systems of classification, etc. ROSENDAHL.
- 118W-119S. CYTOLOGY. A survey of cell structure and the various phenomena of division, fusion, and metamorphosis, together with a review of the history of cytological investigation. Methods of cytological research indicated in the laboratory. ROSENDAHL.
- 131f. FIELD ECOLOGY. A careful study of the local plant communities and successions, followed by a written report, and by a study of the general principles of plant association and succession. COOPER.
- 133S. FOREST GEOGRAPHY OF NORTH AMERICA. Preliminary discussion of principles of plant distribution, followed by detailed study of the forest regions of North America; reading, discussion, lantern slides, distribution maps, microscopic work, written reports. COOPER.
- 141f. ADVANCED PLANT PHYSIOLOGY I. Physical phases of plant physiology. A course dealing with the intake of materials and their translocation, also the energy relations of the plant. KNIGHT.
- 142W. ADVANCED PLANT PHYSIOLOGY II. Plant metabolism. A course dealing with the synthesis of plant food, its transformation and utilization by the plant. KNIGHT.
- 143S. ADVANCED PLANT PHYSIOLOGY III. Plant metabolism and growth. Continuation of 142, also introducing certain fundamental phases of growth. KNIGHT.

CHEMISTRY

THE SCHOOL OF CHEMISTRY

Professors LAUDER W. JONES,² CHARLES F. SIDENER; Associate Professors WILLIAM H. HUNTER, FRANK H. MACDOUGALL; Assistant Professors ISAAC W. GEIGER; Instructor GUY H. WOOLLETT.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f-2W-3S	General Inorganic Chemistry	12	All	None
9f-10W	Advanced General Inorganic Chemistry	10	All	H.-s. chem.
11S	Qualitative Chemical Analysis	4	Soph., jr., sr.	1-2-3

² Resigned, July 1, 1920.

No.	Title	Credits	Offered to	Prerequisite courses
12s-13f	Qualitative Chemical Analysis	10	Soph., jr., sr.	9-10
20w	Quantitative Analysis.....	5	Soph., jr., sr.	12-13
21s	Quantitative Analysis.....	5	Soph., jr., sr.	20
35f-36w	Organic Chemistry.....	10	Soph., jr., sr.	1-2-3 or 9-10

Advanced Courses

126s	Sanitary Water Analysis....	1 or 2	Sr.	21
140f-141w-				
142s	Physical Chemistry.....	9, 12, or 15	Jr., sr.	30 cred. Phys. 15 cred.

For additional courses see the bulletin of the School of Chemistry.

INTRODUCTORY COURSES

1f-2w-3s. GENERAL INORGANIC CHEMISTRY. Designed for those who have had no high-school chemistry. 1-2—A study of the general laws of chemistry and of the non-metals and their compounds. 3—A study of the metals and their compounds. ———

9f-10w. ADVANCED GENERAL INORGANIC CHEMISTRY. Designed for those who have had one year of high-school chemistry. 9—General laws of chemistry, the non-metals and their compounds. 10—Metals and their compounds and ionic equilibrium, considered quantitatively. ———

11s. QUALITATIVE CHEMICAL ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. ———

12s-13f. QUALITATIVE CHEMICAL ANALYSIS. Laboratory work in systematic qualitative analysis with lectures on solution, ionization, chemical and physical equilibrium, oxidation and reduction, and other subjects pertinent to qualitative analysis. ———

20w. QUANTITATIVE ANALYSIS. An introductory course covering the general principles and methods of quantitative analysis, both gravimetric and volumetric. Typical problems will be assigned and attention given to proper laboratory practice. SIDENER, GEIGER.

21s. QUANTITATIVE ANALYSIS. Supplementary to Course 20. Further discussion of the principles and methods together with laboratory work in additional typical problems in gravimetric and volumetric analysis. SIDENER, GEIGER.

35f-36w. ORGANIC CHEMISTRY. An introduction to the chemistry of carbon compounds. The laboratory work will include the preparation of characteristic substances. HUNTER, WOOLLETT.

ADVANCED COURSES

126s. SANITARY WATER ANALYSIS. Lectures and laboratory practice in the chemical examination of potable waters. SIDENER, GEIGER.

140f-141w-142s. PHYSICAL CHEMISTRY. A general survey of the subject. Laboratory work three or six hours per week. Nine, twelve, or fifteen credits, depending on amount of laboratory work. MACDOUGALL.

DAIRY HUSBANDRY ANIMAL INDUSTRY GROUP

Professors CLARENCE H. ECKLES, JOSEPH R. KEITHLEY; Professor Emeritus THEOPHILUS L. HAECKER; Assistant Professors EDWIN O. HANSON, HAROLD MACY, ALLAN B. RAYBURN; Assistants CHESTER DAHLE, OTTO G. SCHAEFER; Extension Specialists ARTHUR J. MCGUIRE, WILLIAM A. MCKERROW, LESLIE V. WILSON.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s	Elements of Dairying.....	5	All	None
2w	Dairy Bacteriology.....	5	Soph., jr., sr.	Bact. 1
3f	Dairy Products.....	5	Jr., sr.	1, 2
4su	Cheese Factory Practice.....	3	Jr., sr.	1, 3
5su	Creamery Practice.....	3	Jr., sr.	1, 3
<i>Advanced Courses</i>				
101f	Milk Production.....	5	Jr., sr.	1
102s	Market Milk.....	3	Jr., sr.	1, 2
103w	Dairy Stock Feeding.....	3	Sr.	101 Agr. Biochem. 15
104s	Advanced Study of Dairy Breeds	3	Jr., sr.	1, 101
105f	Seminar I.....	1	Sr.	3 courses in Dy. Husb.
106w	Seminar II.....	1	Sr.	3 courses in Dy. Husb.
107s	Seminar III.....	1	Sr.	3 courses in Dy. Husb.

INTRODUCTORY COURSES

- 1f,w,s. ELEMENTS OF DAIRYING. Composition of milk. Causes of variation in composition; milk constituents and their uses in dairy manufactures and as food; Babcock test; sanitary handling of milk and cream on the farm; cream-separating and farm butter-making. KEITHLEY, HANSON, DAHLE.
- 2w. DAIRY BACTERIOLOGY. Lectures and laboratory exercises. Types of milk organisms; the contamination of milk and how prevented; relation of milk to the public health; the bacteriology of butter-making and cheese-making. MACY.
- 3f. DAIRY PRODUCTS. The manufacture of butter, cheese, and ice cream with special reference to the chemical and bacteriological processes involved. Laboratory exercises to illustrate these principles. Organization, construction, and equipment of factories; factory accounting. KEITHLEY, DAHLE.

- 4su. CHEESE FACTORY PRACTICE. A minimum of one month's experience in an approved practical cheese factory. Records are kept and reports made. KEITHLEY.
- 5su. CREAMERY PRACTICE. A minimum of one month's experience in an approved practical creamery. Records are kept and a report made. KEITHLEY.

ADVANCED COURSES

- 101f. MILK PRODUCTION. Problems of the dairy farmer, such as characteristics and adaptations of dairy breeds; selection and management of dairy herd and sire; calf-raising; dairy barns. Laboratory: comparative judging and study of breed type. ECKLES, RAYBURN.
- 102s. MARKET MILK. Lectures and laboratory work. Classes of market milk; transportation and marketing; sanitary inspection; equipment of plants; problems of public control. KEITHLEY, MACY.
- 103w. DAIRY STOCK FEEDING. Application of principles of nutrition to feeding the dairy cow and growing young animals. Feeding standards; characteristics of various feeding stuffs; formulation of rations. Only two credits allowed those who have completed An. Husb. 8. ECKLES.
- 104s. ADVANCED STUDY OF DAIRY BREEDS. Practice in comparative judging of dairy cattle representing different breeds and ages; selection and valuation of cattle according to type and pedigree; a study of important strains and families; visits to pure-bred herds. RAYBURN, SCHAEFER.
- 105f. SEMINAR I. Special investigation and study of selected topics. Each student presents papers and reports on assigned subjects and reviews recent scientific investigations along dairy husbandry lines. ECKLES, KEITHLEY.
- 106w. SEMINAR II. Continuation of 105, but 105 not a prerequisite. ECKLES, KEITHLEY.
- 107s. SEMINAR III. Continuation of 106, but 106 not a prerequisite. ECKLES, KEITHLEY.

ECONOMICS

SCHOOL OF BUSINESS

Professors GEORGE W. DOWRIE, JOHN D. BLACK, ROY G. BLAKEY, NORMAN S. BRIEN GRAS, JOHN H. GRAY; Associate Professors WILLIAM W. CUMBERLAND,¹ FREDERICK B. GARVER, ALVIN H. HANSEN, BRUCE D. MUDGETT; Assistant Professors Z. CLARK DICKINSON, CLARENCE L. HOLMES, HOWARD S. NOBLE, THOMAS H. SANDERS, J. WARREN STEHMAN, HOLBROOK WORKING; Professorial Lecturer J. FRANKLIN EBERSOLE; Instructors HILDING E. ANDERSON, CLYDE R. CHAMBERS, JOSEPH E. CUMMINGS, PAUL L. MILLER, VICTOR H. PELZ.

¹ On leave of absence, 1920-21.

COURSES IN AGRICULTURE

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
5f,w ¹	General Economics.....	5	Soph., jr., sr.	None
6f,w,s ¹	Agricultural Economics.....	3	Soph., jr., sr.	3-4, or 5
13s ¹	Agricultural Statistics.....	5	Soph., jr., sr.	3-4, or 5 and 6, or 7
18f ¹	Problems in Agricultural Economics	3	Soph., jr., sr.	3-4, or 5 and 6, or 7
20w-21s ¹	Economic History and Geog- raphy of Agriculture.....	10	All	None
23w	Principles of Organization and Management.....	5	Soph., jr., sr.	3-4, or 5 and 6
25f-26w	Principles of Accounting....	8	Soph., jr., sr.	None
28s ¹	Principles of Accounting (Agricultural)	5	Soph., jr., sr.	3-4, or 5 and 6, or 7
41s	Financial History of United States	3	Soph., jr., sr.	3-4, or 5 and 6
72f	Economics of Transportation	3	Jr., sr.	54
73w	Railway Traffic and Rates..	3	Jr., sr.	3-4, or 5 and 6
74s	Water Transportation.....	3	Jr., sr.	3-4, or 5 and 6
85f-86w	Marketing of Manufactured Products	6	Jr., sr.	3-4, or 5 and 6, and 9 other credits
88s	Advertising	3	Jr., sr.	85-86
89f ²	Marketing of Agricultural Products	5	Jr., sr.	3-4, 5 and 6, or 7
<i>Advanced Courses</i>				
103f-104w	Value and Distribution.....	6	Jr., sr.	3-4, or 5 and 6
107f ¹	Land Economics.....	5	Jr., sr.	18
108w ¹	Farm Marketing Problems..	3	Jr., sr.	89
109w ¹	Economics of Consumption.	3	Jr., sr.	3-4, or 5 and 6, or 7
110s-111f ¹	Practice Course in Marketing	3	Jr., sr.	89
112f-113w	Technique of Statistical In- vestigation	6	Jr., sr.	14
116w ¹	Economics of Agricultural Productions	3	Jr., sr.	18
117s ¹	Prices of Farm Products...	3	Jr., sr.	3-4, or 5 and 6, or 7
121f-122w- 123s	Economic History of Europe		(Not given 1920-21)	
126f-127w- 128s ¹	Special Research Problems in Agricultural Economics....	9	Jr., sr.	
131f	Cost Accounting.....	3	Jr., sr.	25-26
143f-144w	Money and Banking.....	10	Jr., sr.	3-4, or 5 and 6
145s	International Exchange.....	3	Jr., sr.	143-144
146w	Investments	3	Jr., sr.	54, 143-144
149s	Business Cycles.....	3	Sr.	143-144, and 54 or 146
150s ¹	Farm Finance.....	3	Soph., jr., sr.	3-4, or 5 and 6
154s	Public Utilities.....	3	Jr., sr.	54

¹ Given on agricultural campus.

No.	Title	Credits	Offered to	Prerequisite courses
161f	Labor Problems and Trade Unionism	3	Jr., sr.	3-4, or 5 and 6
166f	Employment and Personnel Management	3	Jr., sr.	3-4, or 5 and 6, and Psychology 1-2-3 or equivalent
176f	Commercial Policies.....	3	Jr., sr.	3-4, or 5 and 6
177w	Foreign Trade.....	3	Jr., sr.	176
191f-192w	Public Finance.....	6	Jr., sr.	3-4, or 5 and 6
193s	State and Local Taxation...	3	Jr., sr.	191-192

For additional courses, see bulletin of the School of Business.

INTRODUCTORY COURSES

- 5f,w. GENERAL ECONOMICS. The usual basic principles of economic science interpreted in terms of agriculture and forestry as well as of other industries. HOLMES, WORKING, MILLER.
- 6f,w,s. AGRICULTURAL ECONOMICS. The special body of economic principles that have been developed for agricultural production, exchange, and distribution, together with the application of these principles to agricultural problems. HOLMES, WORKING.
- 13s. AGRICULTURAL STATISTICS. Statistical method applied to agricultural data. BLACK.
- 18f. PROBLEMS IN AGRICULTURAL ECONOMICS. Application of the principles of agricultural economics to a number of the major agricultural problems. Each student partly chooses his own study problems. HOLMES.
- 20w,21s. ECONOMIC HISTORY AND GEOGRAPHY OF AGRICULTURE. (1) The evolution of modern agricultural production, tenure systems, and market distribution. (2) The forces determining past and present localization of agricultural products, types of agricultural production and agricultural markets. HOLMES, CHAMBERS.
- 23w. PRINCIPLES OF ORGANIZATION AND MANAGEMENT. Types of operating organization; specialization; coördination of men and departments; planning; delegation of authority; means of control; establishment and maintenance of standards for materials, operations, machinery; determination of business policies; personnel problems. PELZ.
- 25f-26w. PRINCIPLES OF ACCOUNTING. The purpose and principles of account classification; capital and revenue; accruals; valuation; depreciation; preparation and interpretation of balance sheets, income accounts and other statements; introduction to partnership and corporation accounts. Laboratory course with supplementary lectures. NOBLE and others.
- 28s. PRINCIPLES OF ACCOUNTING (agricultural). Principles of general and cost accounting presented in somewhat abridged form. NOBLE, SANDERS.

- 41s. **FINANCIAL HISTORY OF THE UNITED STATES.** A study of the development of the main features of our systems of money, banking, tariffs, and public finance including a consideration of war financiering and financial cycles. **BLAKEY.**
- 72f. **ECONOMICS OF TRANSPORTATION.** The theory and practice of rate-making. Government regulation, the conflict between state and federal authorities, and suggested improvements in control of transportation agencies. **CUMMINGS.**
- 73w. **RAILWAY TRAFFIC AND RATES.** Railway transportation from standpoint of business man and shipper. Freight shipping documents. Classification and tariffs, time and preference freight, private car lines, industrial trackage and terminal service, express rates and service, special passenger rates. **CUMMINGS.**
- 74s. **WATER TRANSPORTATION.** History and present status of inland waterway and ocean transportation in the United States with some reference to present development in representative foreign countries. Problems peculiar to water transportation in the United States. **CUMMINGS.**
- 85f-86w. **MARKETING OF MANUFACTURED PRODUCTS.** Organization of distributive channels; marketing of basic raw materials and manufactured products; relations, selling problems and methods of manufacturers, wholesalers, retailers, and other factors in the distributive system; price policies; price maintenance. **PELZ.**
- 88s. **ADVERTISING.** Planning and executing campaigns; commodity and market analysis; planning and preparation of copy; selection and use of media; trade marks; display, outdoor and direct advertising; relations of advertiser, agency, and publisher; social and economic aspects. **PELZ.**
- 89f. **MARKETING OF AGRICULTURAL PRODUCTS.** Study of the principles relating to the distribution of farm products; types of markets, middlemen, market organizations; costs; prices; coöperative marketing. **ANDERSON.**

ADVANCED COURSES

- 103f-104w. **VALUE AND DISTRIBUTION.** An advanced course in economic theory devoted chiefly to the study of recent theories of wages, interest, rent, and profits. Assigned readings and reports on current problems in distribution. **GARVER.**
- 107f. **LAND ECONOMICS.** A study of several problems arising out of the land basis of civilization, such as property in land, land utilization, land classification, land settlement, status of the agricultural classes, farm labor, farm ownership and tenancy. **BLACK.**
- 108w. **FARM MARKETING PROBLEMS.** Studies of the problems and methods of marketing selected farm products with special reference to the Twin City markets. **BLACK, ANDERSON.**

- 109w. **ECONOMICS OF CONSUMPTION.** Nature of human wants; standards of living; cost of living; income, administration of income; nature of demand; demand and price; relation of consumption to the population problem. BLACK.
- 110s-111f. **PRACTICE COURSE IN MARKETING.** Eight to twelve weeks of experience as an employee in central or local markets. Careful study and observation of methods. Written plans and reports. BLACK, ANDERSON.
- 112f-113w. **TECHNIQUE OF STATISTICAL INVESTIGATION.** Primary and secondary investigations; statistical units, preparation, filling, and editing of schedules; classification and tabulation of returns; presentation of results. Readings, field work, and reports. MUDGETT.
- 116w. **ECONOMICS OF AGRICULTURAL PRODUCTION.** Detailed analysis of the economic principles underlying agricultural production; economic characteristics and functions of the factors of production; proper combinations of factors; selection of enterprises. HOLMES.
- 117s. **PRICES OF FARM PRODUCTS.** Price determination in the various markets for various classes of farm products; analysis of forces determining prices. BLACK, WORKING.
- 121f-122w-123s. **ECONOMIC HISTORY OF EUROPE, 1300-1750.** The chief interests are the manor; the town; the metropolis; national economic regulations; developments in agriculture, commerce, manufacture, and economic thought, leading up to the industrial revolution. (Not offered in 1920-21.) GRAS.
- 126f-127w-128s. **SPECIAL RESEARCH PROBLEMS IN AGRICULTURAL ECONOMICS.** Intensive individual research work on problems not being studied in the seminar during the quarter. BLACK, HOLMES, WORKING.
- 131f. **COST ACCOUNTING.** General principles of cost accounting; elements of cost; methods of arriving at costs and of distribution of overhead; application of cost accounting principles to selling, banking, mining, farming, etc. NOBLE.
- 143f-144w. **MONEY AND BANKING.** Relation to industrial system. Monetary principles with special reference to United States. American banking and bank organization, principles of commercial banking, non-commercial banking, relation of government to banking, comparative study of leading foreign systems. DOWRIE, STEHMAN, EBERSOLE.
- 145s. **INTERNATIONAL EXCHANGE.** Theory of international exchange, pars of exchange with gold, silver, and paper standard countries; the rates of exchange; financing imports and exports; bankers' bills; futures, arbitrage; specie movements; the present foreign exchange situation. DOWRIE.

- 146w. INVESTMENTS. Sources of demand and supply of capital; bond houses and stock exchanges as marketing media, criteria for personal selection of prime investments; government, municipal, corporation, and real estate loans; and the use of bond tables. EBERSOLE.
- 149s. BUSINESS CYCLES. American business conditions since 1890 with regard to the great cycles of alternate prosperity and depression, and financial panics. Critical examination of all the available business barometers designed to forecast similar conditions. EBERSOLE.
- 150s. FARM FINANCE. The financial needs of typical farmers. Present facilities for supplying them; institutions, their organization and operation, interest rates, defects, and proposed remedies. The financing of the various farm organizations. The farmer as an investor. DOWRIE.
- 154s. PUBLIC UTILITIES. Economic and legal bases of classification. Relative advantages of public ownership and regulation. Central and municipal regulation compared. The basis of rates; relative rates; rates and service. Summary of the theories of valuation. GRAY.
- 161f. LABOR PROBLEMS AND TRADE UNIONISM. Origin of the labor problem; conditions of labor in American industries; structure, aims, policies, and methods of trade and industrial unionism and employers' associations; collective bargaining and shop committees; mediation and arbitration; injunctions; labor legislation. HANSEN.
- 166f. EMPLOYMENT AND PERSONNEL MANAGEMENT. Organization and routine of employment department; selecting employees, records, follow-ups; standardization of labor requirements; problems of labor turn-over; service and welfare features, as safety, education, recreation. Practice in representative establishments. Written report. DICKINSON.
- 176f. COMMERCIAL POLICIES. Theory of international commerce; free trade, reciprocity, protection, subsidies, preferential treatment, the open door, international finance, commercial treaties, foreign policies, and other governmental and organized efforts to affect trade. American problems emphasized. BLAKEY.
- 177w. FOREIGN TRADE. Nature and methods of foreign trade. Character of the foreign trade of the United States and leading countries of the world; organization for foreign trade. BLAKEY.
- 191f-192w. PUBLIC FINANCE. National government revenues, expenditures, and debts. This includes a study of the principles and various forms of taxation, budgetary legislation and control, war and emergency financing, the shifting and incidence of taxes and fiscal reforms. BLAKEY.

193s. STATE AND LOCAL TAXATION. Principles and problems, e.g., state and local taxation of lands, mineral resources, forests, corporation, incomes, inheritances: also studies of classification, separation, local option, exemption, double taxation, evasion, assessment, centralized administration. BLAKEY.

EDUCATION

COLLEGE OF EDUCATION

Professors MELVIN E. HAGGERTY, FLETCHER H. SWIFT; Associate Professor WILFORD S. MILLER; Assistant Professors HERMIONE L. DEALEY, MARVIN J. VAN WAGENEN; Instructors JEAN H. ALEXANDER, FRANCES MOREHOUSE.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s	Brief Course in the History of Education.....	5	Jr., sr.	Psychol. 9 cred. of which 6 may be in educ. psychol.
5s ¹	The American School.....	3	Jr., sr.	Psychol. 6 cred.
11f,w,s	Technique of Teaching.....	3	Jr., sr.	Psychol. 9 cred. of which 6 may be in educ. psychol.
55f,w,s	Elementary Educational Psychology	3	Jr., sr.	Psychol. 6 cred.
<i>Advanced Courses</i>				
101f-102w-103s	Historical Foundations of Modern Education.....	9	Jr., sr.	Psychol. 9 cred. of which 6 may be in educ. psychol. Hist. 10 cred.
106f-107w-108s	Advanced Educational Psychology	9	Sr.	Psychol. 9 cred. of which 6 may be in educ. psychol.
111s	Educational Diagnosis.....	3	Sr.	1-2 or 101-102-103, 3

For additional courses see the bulletin of the College of Education.

¹ Given at University Farm.

INTRODUCTORY COURSES

1f,w,s. A BRIEF COURSE IN THE HISTORY OF EDUCATION. Current school problems and educational theories in the light of their history. Emphasis upon secondary education and those aspects of education of most immediate concern to high-school teachers. Not open to those who have credit in Course 5. ALEXANDER, SWIFT.

- 5s. THE AMERICAN SCHOOL. A brief survey of the factors determining the problem of public education in America, followed by a brief account of the development and organization of typical state school systems. Not open to those who have credit in Course I. ALEXANDER.
- 11f,w,s. TECHNIQUE OF TEACHING. Types of classroom exercises; preparation of teaching plans; hygiene of instruction; classroom management; the professional ethics of teaching; observation of high-school work. MILLER, MOREHOUSE.
- 55f,w,s. ELEMENTARY EDUCATIONAL PSYCHOLOGY. Brief scientific study of individual behavior from standpoint of learning process. Special emphasis, economy of time and energy in learning, instinctive and emotional reactions, habit formation, methods of learning, fatigue. HAGGERTY, DEALEY.

ADVANCED COURSES

- 101f-102W-103s. FOUNDATIONS OF MODERN EDUCATION. Interpretative historical study of elements in modern education derived from Hebrews, Greeks, Romans, Middle Ages, etc. Emphasis upon secondary and higher education, origin and results of monopoly of cultural conception of education and cultural studies. SWIFT.
- 106f-107W-108s. ADVANCED EDUCATIONAL PSYCHOLOGY. Psychology of learning. Methods of measuring rate of learning; study of typical learning experiments and examination of the conditions of the most economic learning, study of individual differences, and psychology of the school subjects. VAN WAGENEN.
- 111s. EDUCATIONAL DIAGNOSIS. A study of educational scales and standard tests for measurement of efficiency in school subjects. The course will deal with the nature of the tests, methods of their use, and an analysis of results obtained. VAN WAGENEN.

ENTOMOLOGY AND ECONOMIC ZOOLOGY

Professors WILLIAM A. RILEY, ARTHUR G. RUGGLES, FREDERIC L. WASHBURN; Associate Professor WILLIAM MOORE; Assistant Professors ROYAL N. CHAPMAN, HARRY H. KNIGHT, OSCAR W. OESTLUND; Instructor SAMUEL A. GRAHAM.

General statement.—Courses in this department are closely correlated with those offered by the Department of Animal Biology of the College of Science, Literature, and the Arts. Courses 37-38-39, 44, 117-118-119, 125-126-127, 130, 139-140, 144-145-146, and 197 of this division are also offered under these numbers by the Department of Animal Biology.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,s,su	Introductory Entomology....	5	Soph., jr., sr.	An. biol. 10 cred.
2w,su	Economic Entomology.....	5	Soph., jr., sr.	1
3f	Elementary Economic Entomology	3	Soph., jr., sr.	An. biol. 10 cred.
4f	Economic Vertebrate Zoology	3	Jr., sr.	An. biol. 10 cred.
5f	Elementary Forest Entomology	3	Soph., jr., sr.	An. biol. 10 cred.
6w	Insects of Forest Products..	3	Soph., jr., sr.	5
12w	Forest Zoology.....	3	Jr., sr.	An. biol. 10 cred.
16s	Plant Pest Control.....	3	Jr., sr.	1-2, or 3, Pl. Path. 1
37f-38w-39s	General Entomology.....	9	Soph., jr., sr.	An. biol. 10 cred.
44s	Introductory Course in Animal Parasites and Parasitism	3	Soph., jr., sr.	An. biol. 10 cred.
<i>Advanced Courses</i>				
117f-118w-119s	General Ecology of Insects..	9	Jr., sr.	1-2 or 37-38-39
125f-126w-127s	Advanced General Entomology	9	Jr., sr.	1-2 or 37-38-39
130w	Biology and Taxonomy of the Aphididae	5	Sr.	1-2 or 37-38-39
139f-140w	Histology and Development of Insects.....	6	Jr., sr.	1-2 and 37-38-39
144f-145w-146s	Animal Parasites and Parasitism	9	Jr., sr.	1-2 and 37-38-39
150f,su	Insecticides and Their Action	3 or 6	Jr., sr.	1-2, or 37-38-39 Agr. Biochem., 7-8 or equiv.
197f,w,s,su	Introduction to Research....	5 or more	Sr.	1-2 or 37-38-39 and other work as prescribed by the division

INTRODUCTORY COURSES

- 1f,s,su. **INTRODUCTORY ENTOMOLOGY.** Lectures and laboratory work on the characteristics and habits of insects. OESTLUND, RILEY.
- 2w,su. **ECONOMIC ENTOMOLOGY.** The life histories, habits and methods of control of the insect pests of orchard, field, and garden. Laboratory work in the determination of the more important forms. RUGGLES.
- 3f. **ELEMENTARY ECONOMIC ENTOMOLOGY.** A brief course dealing with the characteristics and habits of insect pests and beneficial insects and methods of control. Not open to students planning to major in the field of entomology. RUGGLES.

- 4f. **ECONOMIC VERTEBRATE ZOOLOGY.** Relations of birds and wild animals to agriculture. Lectures, laboratory, and field work. Identification and studies of Minnesota birds and wild animals affecting the horticulturist and agriculturist, methods of combating injurious and conserving useful forms. WASHBURN.
- 5f. **ELEMENTARY FOREST ENTOMOLOGY.** A study of the life histories and methods of controlling insects affecting shade and forest trees. Not open for credit to students majoring in the field of entomology. GRAHAM.
- 6w. **INSECTS OF FOREST PRODUCTS.** Treating life history, habits, and control of insects attacking dead or freshly felled wood, and forest products. GRAHAM.
- 12w. **FOREST ZOOLOGY.** Forest animals. Relation of birds and of various four-footed animals to forest protection. Habits, range, usefulness; the manner of protecting the important large and small game, fish, and birds; fish culture. Lectures and laboratory work. WASHBURN.
- 16s. **PLANT PEST CONTROL.** The theory and practice of control of insect and fungous pests of crop plants. Practical applications. Not open to those who have completed Plant Pathology 14. Same as Plant Pathology 6. RUGGLES, STAKMAN.
- 37f-38w-39s. **GENERAL ENTOMOLOGY.** A more extended course than 1, leading up to discussion of the principles of taxonomy and their application to the classification of insects. Textbook, lectures, quizzes, and laboratory. OESTLUND.
- 44s. **INTRODUCTORY COURSE IN ANIMAL PARASITES AND PARASITISM.** Lectures and laboratory work. A consideration of the origin and biological significance of parasitism, and of the structure, life history, and economic relations of representative animal parasites. Methods of control and prevention will be emphasized. RILEY.

ADVANCED COURSES

- 117f-118w-119s. **GENERAL ECOLOGY OF INSECTS.** General ecology with special reference to the insects of Minnesota. Frequent field trips. Lectures, laboratory, and field work. CHAPMAN.
- 125f-126w-127s. **ADVANCED GENERAL ENTOMOLOGY.** Advanced work in the lines of morphology and classification of insects with lectures on the history of entomology. Lectures and laboratory. OESTLUND.
- 130w. **BIOLOGY AND TAXONOMY OF THE APHIDIDAE.** Intensive study of the natural history, bibliography, and classification of the Aphididae. Additional work is offered in Course 197. OESTLUND.
- 139f-140w. **HISTOLOGY AND DEVELOPMENT OF INSECTS.** Lectures and laboratory work on the histology, embryonic and postembryonic development of insects. Individual work along these lines is available to properly qualified students in Course 197. RILEY.

- 144f-145w-146s. ANIMAL PARASITES AND PARASITISM. Lectures and laboratory work. Origin and biological significance of parasitism; structure, life history, and economic relations of representative parasites. Second term devoted primarily to the relation of insects to diseases of man and animals. RILEY.
- 150f,su. INSECTICIDES AND THEIR ACTION. A study of the chemical composition, the physical properties, and the physiological action of standard, of little-known, and of new insecticides. MOORE.
- 197f,w,s,su. INTRODUCTION TO RESEARCH. Preparation for investigational work in lines of entomology, parasitology, or economic zoology. Advanced laboratory, field and library work; training in preparation of bibliographies and manuscripts; special problems. Summer work should be planned when possible. OESTLUND, KNIGHT, Systematic Entomology; RUGGLES, General Economic Entomology; CHAPMAN, Insect Ecology; MOORE, Insecticides; RILEY, Parasitology, Insect Morphology; WASHBURN, Economic Vertebrate Zoology.

FARM ENGINEERING

Professor WILLIAM BOSS; Associate Professor HARRY B. ROE; Assistant Professors JAMES B. TORRANCE, ARTHUR G. TYLER, HALL B. WHITE; Instructors J. GRANT DENT, MAURICE G. JACOBSON, ALLEN D. JOHNSTON.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
3f,s	Mechanical Drawing.....	3	All	None
4w	Blacksmithing	3	All	None
5f	Carpentry	3	All	None
7w	Farm Structures.....	3	Jr., sr.	3
8f,w	Farm Engineering.....	5	All	None
11f,w	Applied Mathematics.....	5	All	None
13f,s	Farm Motors.....	3	All	None
15f,s	Mechanical Laboratory.....	2	All	None
17f	Advanced Blacksmithing....	3	All	4
18s	Surveying	5	Jr., sr. ¹	3, 11 or equiv.
21f-22w	Agricultural Physics.....	10	All	None
28w	Land Clearing.....	3	Jr., sr.	None
29f	Drainage	3	Sr.	8, 18
30s	Household Physics.....	5	All	None

¹ Open also to sophomores in Forestry.

INTRODUCTORY COURSES

- 3f,s. MECHANICAL DRAWING. Materials, instruments, and their uses. The conventions, lettering, scale reading, kinds of drawings, practice in cabinet projection and drawing building plans. JACOBSON.
- 4w. BLACKSMITHING. The management of forge and fire in bending, shaping and welding iron. JOHNSTON.

- 5f. CARPENTRY. The use and care of carpentry tools. The construction of farm equipment such as hayracks, self-feeders, etc. Building construction. Painting and wood finishing. WHITE.
- 7w. FARM STRUCTURES. The planning, designing, and location of farm buildings including specifications and estimates of cost. WHITE.
- 8f,w. FARM ENGINEERING. A general course of farm engineering. Lectures on farm measurements, drainage, water supply, irrigation, sanitation, buildings, roads, power, machinery, and land clearing. BOSS.
- 11f,w. APPLIED MATHEMATICS. Rules of practical mathematics with special attention to formulas and problems directly related to agricultural and forestry work; e.g., areas, volumes, percentages, proportions, variations, investments, cost problems, etc. ROE.
- 13f,s. FARM MOTORS. Theory, operation, care, and repair of gasoline engines. TORRANCE.
- 15f,s. MECHANICAL LABORATORY. Exercises in harness repair, knots and rope splicing, belt lacing, soldering, babbitting, pipe fitting, drilling, and work with cold metals. DENT.
- 17f. ADVANCED BLACKSMITHING. Bending, shaping, welding, and tempering of steel. JOHNSTON.
- 18s. SURVEYING. Plain surveying as applied to farm and forestry. Mensuration, leveling, simple grade determination, elements of topography, and farm-mapping. ROE.
- 21f-22w. AGRICULTURAL PHYSICS. Mechanics of solids and fluids, sound and heat, light, electricity, and magnetism, and their application to farm problems. TYLER.
- 28w. LAND-CLEARING. A study of land-clearing methods, explosives, and machinery. ———
- 29f. FARM DRAINAGE. Principles and practice of farm drainage. Field technique of drainage construction. Drainage administration and law. This course is for students wishing to do special work in drainage. ROE.
- 30s. HOUSEHOLD PHYSICS. Mechanics of solids and fluids; heat, light, sound, electricity, and magnetism. Application of physics to household problems. TYLER.

FORESTRY

Professor EDWARD G. CHEYNEY; Instructor GILBERT H. WIGGIN.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,s	General Forestry	4	All	None
26f,w	Tree Crops.....	1	All	None
27w	Groves and Windbreaks.....	3	All	None

For additional courses see the bulletin of the Courses in Forestry.

INTRODUCTORY COURSES

1f,s. GENERAL FORESTRY. A brief history of the development of forestry in Europe and America; its bearing on the forestry problems of the United States; description of the forests of the United States. Lectures and collateral reading. CHEYNEY.

26f,w. TREE CROPS. The part trees play in the successful development of the farm. The relation of the forests to agriculture and animal husbandry. The farm and the timber supply. CHEYNEY.

27w. GROVES AND WINDBREAKS. Trees and their relation to the farm. Planning and planting farm windbreaks and shelterbelts. Utilization and marketing of farm, grove, or woodlot products. WIGGIN.

GEOLOGY AND MINERALOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors WILLIAM H. EMMONS, FRANK F. GROUT; Assistant Professors THOMAS M. BRODERICK,¹ CHESLEY J. POSEY; Instructors GEORGE M. SCHWARTZ, ARTHUR J. TIEJE.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,s-2w,su	General Geology.....	10 ²	Soph., jr., sr.	Chemistry
4w	Geology of Minnesota.....	5	Soph., jr., sr.	1-2
5f-6w	Economic Geology.....	6 ²	Jr., sr.	1-2
7f,s-8w,su	Laboratory Work.....	2 ²	Soph., jr., sr.	Supports 1-2
11f-12w	General Geology.....	8 ²	Soph., jr., sr.	None
21w-22s	Elements of Mineralogy....	10 ²	Soph., jr., sr.	See statement
29f	General Physiography.....	5	Soph., jr., sr.	None
34w	Meteorology	3	Soph., jr., sr.	None
37s	Economic and Commercial Geography	3	All	None

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

² Both quarters must be completed before credit will be given.

INTRODUCTORY COURSES

1f,s-2w,su. GENERAL GEOLOGY. A synoptical treatment of materials of the earth and of geologic processes. Physiographic, dynamic, structural, and historical geology. Lectures, laboratory work, field excursions, and conferences outside of class hours. EMMONS, TIEJE.

¹ On leave of absence, 1920-21.

- 4w. GEOLOGY OF MINNESOTA. The physical geography and geologic history of Minnesota. The relations of industrial development to geological features. The principles of pre-Cambrian geology as exemplified in Minnesota. (Not offered in 1920-21.)
- 5f-6w. ECONOMIC GEOLOGY. The mineral resources of the United States. The origin, occurrence, distribution, and uses of the more important minerals and mineral fuels of economic value. Lectures, and field excursions. SCHWARTZ.
- 7f,s-8w,su. LABORATORY WORK. Open only to students taking Course 1-2. Supplements Course 1-2 with study of rocks and ores, topographic and geologic maps, and reference reading. ———
- 11f-12w. GENERAL GEOLOGY. A synoptical treatment of materials of the earth and of geologic processes. Physiographic, dynamic, and structural, and historical geology. Lectures, laboratory work, field excursions, and conferences outside of class hours. TIEJE.
- 21w-22s. ELEMENTS OF MINERALOGY. Open to students taking chemistry. The crystal systems; morphological, physical, and chemical character of minerals; occurrence, genesis, and uses of minerals; classification and description of common minerals. Determinative work in laboratory, blowpipe analysis, sight identification. GROUT, BRODERICK.
- 29f. GENERAL PHYSIOGRAPHY. Principles of earth sculpture; physiographic changes in progress, and agencies causing them; hydrography and oceanography; planetary relations; climatology; field excursions. POSEY.
- 34w. METEOROLOGY. The properties and phenomena of the atmosphere, including composition, temperature, pressure, and circulation; the work of the weather bureau; the major climatic divisions of the earth and their climates. POSEY.
- 37s. ECONOMIC AND COMMERCIAL GEOGRAPHY. A study of the geographic factors influencing production and trade. Natural resources in their relation to commerce and industry and the major trade routes will be emphasized. POSEY.

GERMAN

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor CARL SCHLENKER; Assistant Professors OSCAR C. BURKHARD, JAMES DAVIES, ALFRED E. KOENIG, SAMUEL KROESCH, WALTER R. MYERS; Instructors LYNWOOD DOWNS, RICHARD JENTE.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,s	Beginning	5	All	None
2f,w	Beginning, Intermediate.....	5	All	1 or 1 yr. prep. German
3f,s	Beginning, Advanced.....	5	All	2
1of,s	Rapid Reading.....	5	All	3
11w,s	Advanced Rapid Reading....	5	All	10
12f,s	Narrative Prose.....	5	All	2 yrs. prep. Ger- man
13f,w	Advanced Narrative Prose...	5	All	12
28w-29s	Advanced Chemical German.	6 ¹	All	15
31f,w-32w,s	Medical German.....	6 ¹	All	10 or 12 or 15
40w	Commercial German.....	5	All	10 or 13
50f-51w-52s	Composition	3 ¹	Soph., jr., sr.	11 or 13
53f-54w-55s	Conversation	3 ¹	Soph., jr., sr.	11 or 13
62f,s	German Comedies.....	3	Soph., jr., sr.	11 or 13
63w	Modern Drama.....	3	Soph., jr., sr.	11 or 13
64s	Classic Drama.....	3	Soph., jr., sr.	62 or 63

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ All quarters must be completed before credit is granted.

INTRODUCTORY COURSES

- 1f,s. BEGINNING. Pronunciation, conversation, grammar, and composition; selected readings in easy prose and verse. ———
- 2f,w. BEGINNING, INTERMEDIATE. Continuation of Course I. ———
- 3f,s. BEGINNING, ADVANCED. Selected texts from modern writers. ———
- 1of,s. RAPID READING. Modern narrative prose. KROESCH.
- 12f,s. NARRATIVE PROSE. Reading texts selected from modern prose writers. Grammar review and composition. ———
- 13f,w. ADVANCED NARRATIVE PROSE. Continuation of Course 13. ———
- 28w-29s. ADVANCED CHEMICAL GERMAN. Selections from more difficult works on chemistry. SCHLENKER, MYERS.
- 31f,w-32w,s. MEDICAL GERMAN. Readings from general works on physiology, anatomy, and bacteriology. BURKHARD.
- 40w. COMMERCIAL GERMAN. Vocabulary of commerce, business forms; reading of texts on economics.
- 50f-51w-52s. COMPOSITION. Aims to develop grammatical correctness. Translations from English selections. Essay writing on assigned subjects. DAVIES.
- 53f-54w-55s. CONVERSATION. Aims to develop ease and correctness of oral expression. Organized on the laboratory plan—one hour credit with two hours of recitation and one hour of outside reading. MYERS.

62f,s. GERMAN COMEDIES. Reading of the best comedies of the eighteenth and nineteenth centuries. DAVIES, MYERS.

63w. MODERN DRAMA. Plays of modern dramatists; Hauptmann, Sudermann, Fulda, and others. DAVIES, MYERS.

64s. CLASSIC DRAMA. Plays of Lessing, Goethe, and Schiller. DAVIES, MYERS.

HOME ECONOMICS

Professor MILDRED WEIGLEY; Instructor ALICE M. CHILD.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Course</i>				
24s	Camp Cookery.....	3	All	None
For additional courses see the bulletin of the Courses in Home Economics.				

INTRODUCTORY COURSE

24s. CAMP COOKERY. Designed to give prospective foresters, engineers, and others a knowledge of the simpler cookery processes, and of such adaptations as are practicable in the several types of out-of-doors camps. Given in alternate years. (Not offered in 1920-21.) CHILD.

HORTICULTURE

Professors WILLIAM H. ALDERMAN; Associate Professors WILFRID G. BRIERLEY, LEROY CADY, MAXWELL J. DORSEY; Instructor FRED A. KRANTZ; Assistants JOHN W. BUSHNELL, WILLIAM T. TAPLEY; Extension Specialist ROGER S. MACKINTOSH.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
6f	Fruit-Growing	3	Soph., jr., sr.	90, Bot. 10 cred.
21w	Small Fruit Culture.....	3	Soph., jr., sr.	90, Bot. 10 cred.
32s	Vegetable-Growing	3	Soph., jr., sr.	90, Bot. 10 cred.
33w	Vegetable-Forcing	3	Soph., jr., sr.	90, Bot. 10 cred.
35w	Potato Production.....	3	Soph., jr., sr.	90, Bot. 10 cred.
50s	Floriculture	3	All	None
56w,s	Propagation and Nursery Practice	3	Soph., jr., sr.	90
71f	Landscape-Gardening	3	All	None
90f,s	General Horticulture.....	3	All	Soils 2
91s	Advanced General Horticulture	3	Jr., sr. in Agr. Educ.	90
93f	Judging Horticultural Crops.	2	Soph., jr., sr.	90
<i>Advanced Courses</i>				
107f	Orchard Management.....	3	Jr., sr.	6
108w	Fruit-Handling	3	Jr., sr.	90

No.	Title	Credits	Offered to	Prerequisite courses
109f	Principles of Genetics.....	3	Jr., sr.	Bot. 10 cred. An. Biol. 10 cred.
110w	Horticultural Crop-Breeding.	3	Jr., sr.	109
111f	Systematic Pomology.....	3	Jr., sr.	6
131f	Advanced Vegetable Produc- tion	3	Sr.	32
132f	Systematic Olericulture.....	3	Jr., sr.	32
133w	Commercial Truck-Growing..	3	Jr., sr.	90
151f	Advanced Floriculture.....	3	Jr., sr.	50, Bot. 10 cred.
191w-192s	Special Problems.....	6	Jr., sr.	Special permission
193f-194w- 195s	Horticultural Seminar.....	3	Jr., sr.	9 cred.

INTRODUCTORY COURSES

- 6f. FRUIT-GROWING. The fundamental principles of fruit-growing. Sites, soils, nursery stock, planting and planting plans, tillage, fertilization, cover crops, pollination, frost avoidance, pruning, and thinning. Lectures, recitations, references, and laboratory work. BRIERLEY.
- 21w. SMALL FRUIT CULTURE. A study of the cultural practices for each of the small fruits. Brief consideration is given to their botanical relationships and the history of the commercial development. Lectures, problems, and survey of literature. BRIERLEY.
- 32s. VEGETABLE-GROWING. Fundamentals of vegetable-growing applied to commercial and home gardens, scope of vegetable-gardening and place in agriculture. Capital required, locations, soil, equipment, marketing, storage, systems of production. Cultural methods for the various crops. BUSHNELL, TAPLEY.
- 33w. VEGETABLE-FORCING. Commercial growing of vegetables in the greenhouse; types, construction, and management of forcing structures, soils, fertilization, soil sterilization, relation of industry to outdoor vegetable farming, crop production and marketing. TAPLEY.
- 35w. POTATO PRODUCTION. A study of the origin, botany, regional distribution, economic importance, group classification, standardization of varieties according to soil, climate, and markets. Identification, exhibiting, judging, cultural methods, seed selection and certification, marketing and utilization. KRANTZ, TAPLEY.
- 50s. FLORICULTURE. Designed to give the student a working knowledge of the culture and uses of common house plants, annuals, perennials, and greenhouse plants. Lectures, reference-reading, and laboratory. CADY.
- 56w,s. PROPAGATION AND NURSERY PRACTICE. Methods of propagating plants by seed, cuttings, layers, and grafting. Practical work in management of nursery stock, bulbs, and plants. Lectures, reference-reading, and field trips. CADY.

- 71f. **LANDSCAPE-GARDENING.** The practice and principles of landscape-gardening as applied to the home and community. Lectures and field trips to parks and private grounds. CADY.
- 90f,s. **GENERAL HORTICULTURE.** A study of the horticultural industry, including the elements of fruit-growing, vegetable-growing, plant propagation, and landscape-gardening. ALDERMAN, BRIERLEY, CADY, TAPLEY.
- 91s. **ADVANCED GENERAL HORTICULTURE.** For students in agricultural education. Continuation of Course 90 with emphasis given to more advanced problems in orchard and garden management, judging and exhibiting, management of school gardens, ornamental planting of home and school grounds. ALDERMAN, BRIERLEY, CADY, TAPLEY.
- 93f. **JUDGING HORTICULTURAL CROPS.** The principles and practice of judging and exhibiting fruits, vegetables, and flowers. ALDERMAN, BRIERLEY, CADY, TAPLEY.

ADVANCED COURSES

- 107f. **ORCHARD MANAGEMENT.** A detailed study of the various operations in orchards and berry fields. Operating costs and profits. Lectures, laboratory, and individual problems. BRIERLEY.
- 108w. **FRUIT-HANDLING.** A study of fruit-handling operations from orchard to consumer. Lectures, laboratory, assigned readings, and excursions. BRIERLEY.
- 109f. **PRINCIPLES OF GENETICS.** Lectures and laboratory work designed to familiarize the student with the underlying principles of breeding, heredity, variation, biometry, and evolution are emphasized. Same as Agronomy 103. DORSEY, HAYES.
- 110w. **HORTICULTURAL CROP-BREEDING.** Applied genetics are emphasized. The method of breeding each of the important horticultural crops with special attention to experiment station investigations and to the methods used by plant breeders. DORSEY.
- 111f. **SYSTEMATIC POMOLOGY.** A study of fruit varieties. Classification, description, identification, and elements of judging. Lectures, laboratory, and a survey of the literature. ALDERMAN, BRIERLEY.
- 131f. **ADVANCED VEGETABLE PRODUCTION.** A study of the business of vegetable-gardening, special problems, variety improvement, production of seed, investigation and research, reviews and reports on recent literature. TAPLEY.
- 132f. **SYSTEMATIC OLERICULTURE.** The origin, botany, varieties, and types of the different vegetables, their characteristics and adaptation to different cultural and market conditions, identification and classification studies, judging and exhibiting. TAPLEY.

- 133w. COMMERCIAL TRUCK-GROWING. Truck-growing centers of the United States, cultural methods, special machinery and equipment, market methods, shipping points. Adaptation of the truck crops to Minnesota, commercial production for canneries, handling and shipping. TAPLEY.
- 151f. ADVANCED FLORICULTURE. Lectures, assigned readings, laboratory, and special problems dealing with the culture, botany, and history of florists' plants and methods of greenhouse management. CADY.
- 191w-192s. SPECIAL PROBLEMS. A study of problems based upon the work given in the preceding courses. ALDERMAN.
- 193f-194w-195s. HORTICULTURAL SEMINAR. Reports and discussions of problems and investigational work. Horticultural Staff.

MILITARY SCIENCE AND TACTICS

Professor ALBERT G. GOODWYN, Captain, Infantry, U.S.A., Chairman; Assistant Professors BEN W. FIELD, Captain, Infantry, U.S.A.; LAURENCE T. WALKER, Captain, Coast Artillery Corps, U.S.A.; LEE R. WATROUS, JR., Captain, Coast Artillery Corps, U.S.A.; EDGAR B. MOOMAU, 1st Lieutenant, Infantry, U.S.A.; HARVEY G. THOMAS, 1st Lieutenant, U.S.A., Retired; Instructors JOEL R. BAKER, Master Signal Electrician, Signal Corps, U.S.A.; ALFRED BRANDT, Regimental Sergeant Major, Infantry, U.S.A.; HENRY W. BROWN, Sergeant, Coast Artillery Corps, Unassigned, U.S.A.; KENNA B. CALDWELL, Sergeant, Coast Artillery Corps, Unassigned, U.S.A.; AUBREY R. DUNKUM, 1st Sergeant, Coast Artillery Corps, Unassigned, U.S.A.; WILLIAM FINKE, 1st Sergeant, Coast Artillery Corps, Unassigned, U.S.A.; JOSEPH HAVLICEK, Regimental Commissary Sergeant, Infantry, U.S.A., Retired; WILLIAM L. HOGAN, 1st Sergeant, Coast Artillery Corps, Unassigned, U.S.A.; INGVALD M. JOHNSON, 1st Sergeant, Infantry, Unassigned, U.S.A.; JOSEPH LEES, 1st Sergeant, Infantry, U.S.A., Retired; JOHN MCWILLIAMS, 1st Sergeant, Infantry, U.S.A., Retired; WILLIAM G. PALMS, Sergeant, Infantry, Unassigned, U.S.A.

COURSES

No.	Title	Credits	Prerequisite courses
<i>Introductory Courses</i>			
1	First-Year Basic Course		
	R.O.T.C.	None	None ¹
2a	Second-Year Basic Course		
	R.O.T.C., Infantry.....	None	1
2b	Second-Year Basic Course		
	R.O.T.C., Coast Artillery..	None	1
2c	Second-Year Basic Course		
	R.O.T.C., Signal Corps...	None	1

¹ Must be legally eligible for enrollment in Reserve Officers' Training Corps.

No.	Title	Credits	Offered to	Prerequisite courses
<i>Advanced Courses</i>				
3a	First-Year Advanced Course R.O.T.C., Infantry.....			2a
3b	First-Year Advanced Course R.O.T.C., Coast Artillery..			2b
3c	First-Year Advanced Course R.O.T.C., Signal Corps....			2c
4a	Second-Year Advanced Course R.O.T.C., Infantry.....			3a
4b	Second-Year Advanced Course R.O.T.C., Coast Artillery.			3b
4c	Second-Year Advanced Course R.O.T.C., Signal Corps....			3c

MUSIC

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professor CARLYLE M. SCOTT; Assistant Professor DONALD N. FERGUSON;
Instructors ABE PEPINSKY, GERTRUDE REEVES.

General statement.—Credit is offered to seniors and juniors in the College of Agriculture, Forestry, and Home Economics, who may wish to elect work in the Department of Music. Nine credits may be obtained.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
14f-15w-16s	History of Music.....	9 ²	Soph., jr., sr.	None
17f-18w-19s	Appreciation of Music.....	3 ²	Jr., sr.	None
51f-52w-53s ¹	Violin	6-12 ²	Jr., sr.	None
91f-92w-93s ¹	Orchestra	3 ²	Jr., sr.	See statement
97f-98w-99s	Choir	3	Jr., sr.	None

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ Given at University Farm.

² The full course must be completed before credit will be allowed.

INTRODUCTORY COURSES

14f-15w-16s. HISTORY OF MUSIC. Some account of primitive systems and of the early Christian modal and harmonic development, leading to a general survey of musical literature from Bach to the present time. FERGUSON.

17f-18w-19s. APPRECIATION OF MUSIC. A non-technical course. REEVES.

51f-52w-53s. VIOLIN. Candidate must be able to play the first ten of Kreutzer's forty etudes, and the easier Handel and Mozart sonatas. PEPINSKY.

91f-92w-93s. ORCHESTRA. PEPINSKY.

97f-98w-99s. CHOIR. SCOTT.

PHYSICAL EDUCATION

FOR MEN

Director LOUIS J. COOKE; Assistant Director WILLIAM K. FOSTER; Instructors EDWIN S. BROWN, PERCY C. GLIDDEN, D. C. MITCHELL, CARL B. ROEMER; Assistants FRANK GILMAN, HARRY GOLDIE.

General statement.—The purpose of the department is to provide all men of the University opportunity for exercise in order to maintain and build up their general health. It also provides special training for the correction of physical defects and functional derangements.

A physical examination is required of all new matriculants, and of all others using the department privileges, at the beginning of the year, and as often during their college course as their physical condition may indicate. Students taking the required work in physical education are examined at the close of the year. A study of these records shows a marked improvement in the standard of health of the average student during his college course.

The gymnasium, swimming-pool, and baths are open to all students of the University, who are free to use the apparatus and to pursue a course in physical training under the supervision of the director and his assistants.

Those students taking the required course in physical education, who can not swim must make a reasonable effort, as determined by the department, to pass the swimming and life-saving requirements, and will be assigned special hours for instruction.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s	Personal Hygiene.....	1	Fr.	None
2f-3w ¹ -4s	Gymnasium and Swimming..	None	Fr.	None
5f-6w-7s	Advanced Leaders.....	3 ²	Soph., jr., sr.	Instructor's permission
8f-9w-10s	Corrective Gymnastics.....	None	All	None
11w-12s ³	Wrestling	None	All	Instructor's permission
13f-14w-15s ³	Intermediate Swimming....	None	All	Instructor's permission
16f-17w-18s ³	Advanced Swimming.....	None	All	Instructor's permission
19w-20s ³	Boxing	None	Fr.	None
21f-22w-23s ³	Intramural Athletics.....	None	All	None

¹ Given at University Farm.

² Full course must be completed before credit is allowed.

³ Students who meet all the requirements of Course 2 and show special ability may elect these courses instead of Course 2.

COURSES

1f,w,s PERSONAL HYGIENE. Two hours per week; first six weeks of each quarter. Examination at close of course. Four hours per week collateral work with themes. COOKE, BROWN, FOSTER.

- 2f-3w-4s. GYMNASIUM AND SWIMMING. Two hours a week for the winter quarter. Required qualifications in swimming, life-saving, bar-vaulting, jumping, sprinting, running, and on heavy apparatus. FOSTER, GLIDDEN, MITCHELL, ROEMER.
- 5f-6w-7s. ADVANCED LEADERS. Three hours a week. FOSTER.
- 8f-9w-10s. CORRECTIVE GYMNASTICS. Three to six hours a week instead of regular gymnasium or military drill in case of physical disability. BROWN.
- 11w-12s. WRESTLING. Three times per week. Students admitted by special assignment.
- 13f-14w-15s. INTERMEDIATE SWIMMING. Life-saving, efficiency swimming, and fancy diving. Instruction is given in rescuing and restoring the apparently drowned and other useful swimming accomplishments. GLIDDEN.
- 16f-17w-18s. ADVANCED SWIMMING. Life-saving, efficiency swimming, and fancy diving. Instruction is given in rescuing and restoring the apparently drowned and other useful swimming accomplishments. GLIDDEN.
- 19w-20s. BOXING. By special arrangement a few students may be accommodated in this class which meets twice per week. GOLDIE.
- 21f-22w-23s. INTRAMURAL ATHLETICS. Competitive games in the various athletic leagues in football, basket-ball, hockey, track, and field events, baseball, tennis, swimming, handball, bowling, etc. FOSTER.

PHYSICS

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors HENRY A. ERIKSON, ANTHONY ZELNY; Professorial Lecturer LOUALLEN F. MILLER; Instructor JOSEPH VALASEK.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
21f,w,s,su	Elements of Mechanics.....	3	All	Trigonometry
22f,w,s,su	Elements of Mechanics Laboratory	1	All	21 or parallel
31f	Acoustics	3	All	None
41w	Heat	3	All	21
42w	Heat Laboratory.....	1	All	22, 41 or parallel
51f	Light	3	All	21
52f	Light Laboratory.....	1	All	22, 51 or parallel
61s	Magnetism and Electricity...	3	All	21
62s	Magnetism and Electricity Laboratory	1	All	22, 61 or parallel

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

INTRODUCTORY COURSES

- 21f,w,s,su. ELEMENTS OF MECHANICS AND SOUND. Mechanics of solids, fluids, wave motion, and sound. A study of the simpler fundamental principles. First part of a general Course 21, 41, 51, 61. Course 22 should be taken in conjunction with this course. ERIKSON.
- 22f,w,s,su. ELEMENTS OF MECHANICS LABORATORY. Measurements in the mechanics of solids, fluids, and wave motion; the laboratory part supplementing Course 21. ERIKSON.
- 31f. ACOUSTICS. A study of the fundamental principles of sound. A course designed primarily for the students in the Department of Music. Open also to other students. ERIKSON.
- 41w. HEAT. A study of the principles underlying heat phenomena. Course 42 should be taken in conjunction with this course. MILLER.
- 42w. HEAT LABORATORY. The laboratory part supplementing Course 41. MILLER.
- 51f. LIGHT. A study of the principles underlying light phenomena. Course 52 should be taken in conjunction with this course. VALASEK.
- 52f. LIGHT LABORATORY. The laboratory part supplementing Course 51. VALASEK.
- 61s. MAGNETISM AND ELECTRICITY. A study of the principles underlying magnetic and electric phenomena. Course 62 should be taken in conjunction with this course. ZELENY.
- 62s. MAGNETISM AND ELECTRICITY. The laboratory part supplementing Course 61. ZELENY.

PLANT PATHOLOGY AND BOTANY

Professors EDWARD M. FREEMAN, ELVIN C. STAKMAN; Instructors HENRY D. BARKER, ALVIN H. LARSON, GAIL F. PUTTICK; Extension Specialist FRANK FROLIK.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f-su	Plant Pathology.....	5	Jr., sr.	Bot. 10 cred.
6s	Plant Pest Control.....	3	Jr., sr.	1, Ent. 3
7w-8s	Weeds and Grasses.....	6	Soph., jr., sr.	Bot. 10 cred.
9f,su	Weeds and Seed-Testing....	3	Soph., jr., sr.	Bot. 10 cred.
10s	Forest Pathology.....	5	Soph., jr., sr.	Bot. 10 cred.
12w	Seed Problems.....	3	Jr., sr.	9
14s	Plant Disease Control.....	5	Jr., sr.	1, Ent. 1 or 3

No.	Title	Credits	Offered to	Prerequisite courses
<i>Advanced Courses</i>				
105f-106w-107s	Mycology	9	Jr., sr.	Bot. 7, 11 or equiv.
108f-109w	Methods	6	Jr., sr.	1, Bact. 1
110s	Principles of Pathology.....	3	Jr., sr.	1, Bact. 1
111w,su	Diseases of Field Crops.....	3	Jr., sr.	1
112s,su	Diseases of Fruit and Vegetable Crops.....	3	Jr., sr.	1

INTRODUCTORY COURSES

- 1f,su. PLANT PATHOLOGY. Elementary study of plant diseases due to fungi, bacteria, and slime molds; life histories and preventive methods. Lectures, laboratory, and reference. Not open to those who have completed 10. STAKMAN, PUTTICK.
- 6s. PLANT PEST CONTROL. The theory and practice of control of insect and fungous pests of crop plants. Practical applications. Same as Entomology 16. Not open to those who have completed 14. PUTTICK.
- 7w-8s. WEEDS AND GRASSES. Agricultural and applied botanical study of weeds and grasses with special reference to agricultural importance. LARSON.
- 9f,su. WEEDS AND SEED-TESTING. Detailed study of seed-testing methods and seed legislation. Weed and crop seeds and weed plants studied with special reference to identification. LARSON.
- 10s. FOREST PATHOLOGY. Elementary study of plant diseases due to fungi, bacteria, and slime molds; life histories and preventive methods. Lectures, laboratory, and reference. Not open to those who have completed 1. (Offered in alternate years. Given in 1920-21.) STAKMAN, PUTTICK.
- 12w. SEED PROBLEMS. Special seed problems are assigned. Advanced work in seed-testing methods. LARSON.
- 14s. PLANT DISEASE CONTROL. A detailed study of methods of controlling diseases of plants of parasitic origin. Spray materials and spray machinery. Practical applications. Not open to those who have completed 6. (Offered in alternate years. Given in 1920-21.) ———

ADVANCED COURSES

- 105f-106w-107s. MYCOLOGY. A general study of the morphology, taxonomy, and biology of fungi. Lectures, laboratory, greenhouse, and field work. FREEMAN, STAKMAN.
- 108f-109w. METHODS. Plant pathological methods including mycological and bacteriological technique. Laboratory, lecture, and greenhouse work. Special problems. STAKMAN.

1105. PRINCIPLES OF PATHOLOGY. Comparative biology of plant pathogens; pathological plant anatomy; parasitism, biologic specialization, resistance, and immunity. Will be given in close coöperation with Agricultural Biochemistry Division and divisions offering work in plant breeding. STAKMAN.
- 111W,SU. DISEASES OF FIELD CROPS. Detailed study of diseases of cereal and forage crops, including symptomology, etiology, and practical methods of control. Laboratory, lecture, and field work. STAKMAN, BARKER.
- 112S,SU. DISEASES OF FRUIT AND VEGETABLE CROPS. Special study of diseases of fruit and vegetable crops, especially those important in Minnesota. Laboratory, lecture, and greenhouse work. —————

POLITICAL SCIENCE

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Assistant Professor ALBERT J. LOBB.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f ¹	American Government.....	5	Soph., jr., sr.	None
7f,w	State and Local Government.	5	Soph., jr., sr.	1
28s ¹	Business Law.....	5	Jr., sr.	10 cred. in Pol. Sci. or Econ.
41s ¹	Rural Government.....	3	All	1

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ Given at University Farm.

INTRODUCTORY COURSES

- 1f. AMERICAN GOVERNMENT. Organization and actual workings of the national government; nature and origin of the American governmental system.
- 7f,w. STATE AND LOCAL GOVERNMENT. Comparison of American state governments, especially Minnesota; relation of states to the United States and to local units of government; recent experiments such as initiative and referendum, the recall and primaries; social and economic legislation. LOBB.
- 28s. BUSINESS LAW. A course in Business Law (arranged for students in the College of Agriculture, Forestry, and Home Economics), including contracts, agency, mortgages, conveyances, and negotiable instruments. LOBB.
- 41s. RURAL GOVERNMENT. The organization and functions of towns, school districts, villages, and counties; the assessment and taxation of property; road laws; and drainage. LOBB.

POULTRY HUSBANDRY

ANIMAL INDUSTRY GROUP

Professor ARTHUR C. SMITH; Extension Specialist NORTON E. CHAPMAN.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w	Poultry	3	All	None
2w	Poultry-Judging	3	All	1
4s	Incubating and Brooding....	3	All	None
5s	Advanced Poultry-Judging..	3	All	2

INTRODUCTORY COURSES

- 1f,w. POULTRY. The poultry industry; best methods of care and management of fowls, turkeys, ducks, and geese, and the most important breeds of same. SMITH.
- 2w. POULTRY-JUDGING. The history, standard requirements, and common defects of the leading commercial, standard breeds and varieties and determination and standard values by the score-card and comparison methods. SMITH.
- 4s. INCUBATING AND BROODING. Instruction and practice in incubation and brooding, selection of breeding stock and eggs for hatching, and feeding young chicks. Of practical value to teachers of agriculture and poultry raisers. SMITH.
- 5s. ADVANCED POULTRY-JUDGING. Practice in close selection for standard values of all different color patterns and principal types. SMITH.

PSYCHOLOGY

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Associate Professors RICHARD M. ELLIOTT, WILLIAM S. FOSTER, HERBERT WOODROW;¹ Assistant Professors MABEL R. FERNALD, KARL S. LASHLEY, JOHN J. B. MORGAN; Instructors FRANCES E. LOWELL, PAUL T. YOUNG.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f-2w-3s	General Psychology.....	9	Soph., jr., sr.	None
4f-5w-6s	Introductory Laboratory Psychology	3	Soph., jr., sr.	An. biol. 10 cred. In 1920-21 physics, bot. or chem. may be substituted
8s	Applications of Psychology to Business '.....	3	Bus., pre-bus. students	1-2

¹ On leave of absence, 1920-21.

No.	Title	Credits	Offered to	Prerequisite courses
<i>Advanced Courses</i>				
101f-102w-103s	Experimental Psychology....	9	Jr., sr.	1-2-3, 4-5-6
108w-109s	Advanced General Psychology	6	Sr., grad.	101-102-103 or by permission
114w-115s	Human Behavior.....	6	Jr., sr.	1-2-3, 4-5-6 an. biol. 10 cred.
119f-120w	Animal Behavior.....	6	Jr., sr.	1-2-3, 4-5-6 an. biol. 10 cred.
121s	Neuro-Psychology	3	Jr., sr.	1-2-3, 4-5-6 an. biol. 10 cred.
125f-126w	Differential Psychology.....	6	Jr., sr.	1-2-3, 4-5-6
127w-128s	Social Psychology.....	3	Jr., sr.	1-2-3, 4-5-6
131f-132w	Child Mind.....	6	Jr., sr.	1-2-3, 4-5-6
144f-145w	Abnormal Psychology.....	6	Jr., sr.	1-2-3, 4-5-6
156w	Psychology of Advertising..	3	Jr., sr.	1-2, 8
160f	Employment Psychology....	3	Jr., sr.	1-2, 8

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

INTRODUCTORY COURSES

1f-2w-3s. GENERAL PSYCHOLOGY. An introductory survey of psychology; its material, fundamental laws, applications, and relations to other sciences. Two lectures, one recitation per week. ELLIOTT.

4f-5w-6s. INTRODUCTORY LABORATORY PSYCHOLOGY. Simple experiments providing the beginner illustrative material and training in the methods of laboratory psychology. Required for all advanced courses in psychology, except 8, 156, and 160. Two laboratory hours per week. FOSTER.

8s. APPLICATIONS OF PSYCHOLOGY TO BUSINESS. An introduction to business psychology. Business students only. MORGAN.

ADVANCED COURSES

101f-102w-103s. EXPERIMENTAL PSYCHOLOGY. Experimentation in the analysis and measurements of mental phenomena. Assigned reading and reports on special topics. One lecture, four laboratory hours per week. FERNALD.

108w-109s. ADVANCED GENERAL PSYCHOLOGY. A systematic presentation of the laws of the normal adult mind, based upon study of experimental results. Lectures, recitations, and reports. YOUNG.

114w-115s. HUMAN BEHAVIOR. An analysis from the point of view of the objective school of psychologists. ELLIOTT.

119f-120w. ANIMAL BEHAVIOR. The development of reaction-system in animals, with emphasis upon the application of studies of animals to the solution of general problems in physiological psychology. LASHLEY.

- 121s. **NEURO-PSYCHOLOGY.** Specialization of functions in the nervous system in relation to behavior. Discussion from the standpoint of psychology of current theories of integration and localization. LASHLEY.
- 125f-126w. **DIFFERENTIAL PSYCHOLOGY.** Important distinguishing characteristics (psychological) of individuals and of groups. Emphasis on experimental and statistical methods of discovering differences and of making comparisons. Each student participates in investigation of definite problems and in analysis of results. FERNALD.
- 127w-128s. **SOCIAL PSYCHOLOGY.** A study of the dependence of familiar forms of social organization and behavior upon the fundamental laws of mental activity. The adjustment of innate mental equipment of the individual to the forms of social groups. —————
- 131f-132w. **CHILD MIND.** General intelligence and special mental abilities; their development and their relation to heredity, physiological factors, education, speech defects, and delinquency. LOWELL.
- 144f-145w. **ABNORMAL PSYCHOLOGY.** A systematic review of psychopathology in relation to normal behavior. LASHLEY.
- 156w. **PSYCHOLOGY OF ADVERTISING.** Psychology as applied to advertising. Psychological analysis of advertisements followed by experimental investigation of the value in advertising of such factors as interest, attention, suggestion, and memory. MORGAN.
- 160f. **EMPLOYMENT PSYCHOLOGY.** Psychology as applied to employment problems. Standardization of the personal interview; the principles and development of test methods; personnel classification methods. Independent investigations required of each student. MORGAN.

RURAL PUBLICATIONS AND JOURNALISM

Professor WILLIAM P. KIRKWOOD; Extension Specialist EDWIN C. TORREY.

General statement.—The aim of this division is to give practical training in agricultural journalism and in agricultural publicity and bulletin writing.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
10f-11w-12s	Agricultural Journalism.....	9	Jr., sr.	13-14-15, 16-17
19s	Agricultural Publicity.....	3	Jr., sr.	Rhet. 19 cred. or rhet. 9 cred., Eng. 9 cred.

For additional courses in journalism see the bulletin of the College of Science, Literature, and the Arts.

INTRODUCTORY COURSES

- 10f-11w-12s. AGRICULTURAL JOURNALISM. Gathering and writing agricultural news and writing articles for the agricultural press and other class papers; farm paper editing. Lectures and practical work. KIRKWOOD.
- 19s. AGRICULTURAL PUBLICITY. Mediums and methods through which information may be brought to attention of communities and people of the open country. KIRKWOOD.

RHETORIC.

Assistant Professors ROBERT C. LANSING, HARRY J. BURTIS; Instructors LIONEL CROCKER, RUTH MOHL.

General statement.—Rhetoric credits will not be granted officially until the close of the second quarter of the senior year.

Any instructor who finds that a student is deficient in English will submit the name of the student together with the evidence to the chairman of the Students' Work Committee. If the evidence warrants, the committee will send the student to the Section of Rhetoric for such additional work in English as is needed. This work the student must take, without credit, to validate his freshman and sophomore rhetoric credits.

Students whose work in the rhetoric courses shows at any time an inadequate knowledge of the conventions of English will be required to drop the course and enter a class in elementary rhetoric. These students will be required to complete 22 credit hours in rhetoric.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s	Rhetoric I.....	3	All	None
2f,w,s	Rhetoric II.....	3	All	1
3w,s	Rhetoric III.....	3	All	2
4f,w,s	Elementary Rhetoric.....	3	All	None
11f,w,s	Argumentation	5	Soph., jr., sr.	3
22f,w,s	Public Speaking.....	5	Soph., jr., sr.	3
24f,w,s	Advanced Public Speaking..	3	Soph., jr., sr.	22

INTRODUCTORY COURSES

- 1f,w,s. RHETORIC I. Note-taking, gathering and organizing material, oral and written exposition, paragraph structure, supplementary reading. LANSING, CROCKER, MOHL.
- 2f,w,s. RHETORIC II. Sentence structure, diction, exposition, supplementary reading. LANSING, CROCKER, MOHL.
- 3w,s. RHETORIC III. Description, narration, supplementary reading. LANSING, CROCKER, MOHL.
- 4f,w,s. ELEMENTARY RHETORIC. Elementary grammatical and rhetorical principles. MOHL.

- 11f,w,s. ARGUMENTATION. Gathering evidence, reasoning, briefing, formal and informal argument, persuasion, debating. LANSING, BURTIS, MOHL.
- 22f,w,s. PUBLIC SPEAKING. A practical course in fundamentals of speech-making. Rules of order and practice in conducting assemblies included. BURTIS.
- 24f,w,s. ADVANCED PUBLIC SPEAKING. A course in preparing and delivering occasional addresses and informal lectures. BURTIS.

ROMANCE LANGUAGES

COLLEGE OF SCIENCE, LITERATURE, AND THE ARTS

Professors EVERETT W. OLMSTED, COLBERT SEARLES; Associate Professors RALPH E. HOUSE, RUTH S. PHELPS; Assistant Professors FRANCIS B. BARTON, JULES F. FRELIN, EDWARD H. SIRICH, PEDRO HENRÍQUEZ UREÑA; Professörial Lecturer ANTONIO HERAS; Instructors SOLOMON M. DELSON, CHARLES B. DRAKE, MARGUERITE GUINOTTE, SAMUEL VASCONCELOS, GUSTAVE VAN ROOSBROECK.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s-2w,s,f	Beginning French.....	10 ¹	All	None
3f,w,s-4w,s,f	Intermediate French.....	10	All	1-2 or 2 yrs. H.S.
20f,s	Oral and Written French....	5	All	3-4 or 3 yrs. H.S.
21f-22w-23s	Survey of French Literature	9 ¹	All	3-4 or 3 yrs. H.S.
50f-51w-52s	French Conversation.....	3 ^{1,2}	Jr., sr.	3-4 or 3 yrs. H.S.
53f-54w-55s	French Composition.....	3 ^{1,2}	Jr., sr.	3-4 or 3 yrs. H.S.
1f,w,s-2w,s,f	Beginning Spanish.....	10 ¹	All	None
3f,w,s-4w,s,f	Intermediate Spanish.....	10	All	1-2 or 2 yrs. H.S.
20f,s	Oral and Written Spanish...	5	All	3-4 or 3 yrs. H.S.
50f-51w-52s	Spanish Conversation.....	3 ^{1,2}	Jr., sr.	3-4 or 3 yrs. H.S.
53f-54w-55s	Spanish Composition.....	3 ^{1,2}	Jr., sr.	3-4 or 3 yrs. H.S.
65f-66w-67s	Survey of Spanish Literature	9 ¹	Jr., sr.	3-4 or 3 yrs. H.S.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ The full course must be completed before credit will be allowed.

² Open without petition to sophomores who can satisfy the requirements.

INTRODUCTORY COURSES

- 1f,w,s-2w,s,f. BEGINNING FRENCH. Pronunciation, grammar, oral exercises, translation. FRELIN, DELSON, GUINOTTE.
- 3f,w,s-4w,s,f. INTERMEDIATE FRENCH. Review of grammar, connected prose composition, conversation, and reading of representative authors. FRELIN, GUINOTTE.
- 20f,s. ORAL AND WRITTEN FRENCH. Practical French conversation and composition. BARTON.

- 21f-22w-23s. SURVEY OF FRENCH LITERATURE. This course will outline the history of French literature from 1600 to present day, and is prerequisite for the courses devoted to special periods. Representative texts will be read. PHELPS, SEARLES, VAN ROOSBROECK.
- 50f-51w-52s. ELEMENTARY FRENCH CONVERSATION. A small amount of outside preparation will be required. BARTON, FRELIN, GUINOTTE.
- 53f-54w-55s. ELEMENTARY FRENCH COMPOSITION. BARTON, FRELIN, GUINOTTE.
- 1f,w,s-2w,s,f. BEGINNING SPANISH. Pronunciation, grammar, oral exercises and translation. OLMSTED, DRAKE, VASCONCELOS.
- 3f,w,s-4w,s,f. INTERMEDIATE SPANISH. Review of grammar, conversation, connected prose composition, and reading of representative authors. HOUSE, VASCONCELOS.
- 20f,s. ORAL AND WRITTEN SPANISH. Practical Spanish conversation and composition. DRAKE.
- 50f-51w-52s. SPANISH CONVERSATION. A small amount of outside preparation will be required. HERAS.
- 53f-54w-55s. SPANISH COMPOSITION. HERAS.
- 65f-66w-67s. SURVEY OF SPANISH LITERATURE. An outline of the history of Spanish literature from 1500 to the present day, based upon texts and collateral reading. Prerequisite for courses devoted to special periods. HOUSE.

SOCIOLOGY AND SOCIAL WORK

Professor ARTHUR J. TODD;¹ Acting Chairman FRANK J. BRUNO; Associate Professors LUTHER L. BERNARD, MANUEL C. ELMER; Assistant Professors ROSS L. FINNEY, GUSTAV A. LUNDQUIST; Instructors LOUIS A. BOETTIGER, CHARLES E. LIVELY; Teaching Fellow ANDREW N. WRAY.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
1f,w,s	Introduction to Sociology....	3 or 5 ²	Soph., jr., sr.	None
6f,w,s	Modern Social Reform Movements	3	Soph., jr., sr.	1
14f,w,s	Rural Sociology.....	3	Soph., jr., sr.	1 ³
<i>Advanced Courses</i>				
114s	Rural Social Institutions....	3	Jr., sr.	Soc. 10 cred. or 10 cred. in Soc. and Pol. Sci., Econ. or Psych.

For additional courses see the bulletin of the College of Science, Literature, and the Arts.

¹ On leave of absence 1920-21.

² Offered as a three-credit course at University Farm, fall and spring quarters. Open only to students in Agriculture, Forestry, and Home Economics.

³ No prerequisite for seniors in the College of Agriculture, Forestry, and Home Economics.

INTRODUCTORY COURSES

- 1f,w,s. **INTRODUCTION TO SOCIOLOGY.** A study of the origin and development of human societies; various agencies which have determined the type of social life; social organization, institutions, and progress; bearing of sociology upon other social sciences and arts. BERNARD, ELMER, FINNEY, LUNDQUIST, BOETTIGER, LIVELY, WRAY.
- 6f,w,s. **MODERN SOCIAL REFORM MOVEMENTS.** A survey of attempts to overcome certain social maladjustments: child labor, the city, bad housing, poverty, degeneracy; movements for public health, industrial democracy, social insurance, protection of infancy and youth, public recreation, etc. ELMER, FINNEY, BOETTIGER, LIVELY.
- 14f,w,s. **RURAL SOCIOLOGY.** The background and evolution of country life; rural conveniences, communication, coöperation; rural social institutions, especially the family, school, church and social center; rural leadership, surveys, organization, social agencies. BERNARD, LUNDQUIST, LIVELY.

ADVANCED COURSES

- 114s. **RURAL SOCIAL INSTITUTIONS.** A detailed study of the problems of organization and efficiency of selected rural institutions, especially religious, educational, civic, and recreational. Lectures, discussion, reports. LUNDQUIST.

SOILS

Professor FREDERICK J. ALWAY; Assistant Professor CLAYTON O. ROST;
Instructor PAUL R. McMILLER; Extension Specialist GEORGE H. NESOM.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
2f,w	Elementary Soils	2	All	None
3s	Soils	3	Jr., sr.	Chem. 10 cred.
<i>Advanced Courses</i>				
101f	Chemical Analysis of Soils..	5	Sr.	3 Quant. Anal.
102f,w,s	Special Problems in Soils....	1	Sr.	101, 103
103w	Mechanical Analysis of Soils	3	Jr., sr.	3
104s	Soil-Surveying	3	Jr., sr.	3, 103
105w	Minnesota Soils.....	3	Sr.	3

¹ Credit according to the amount of work.

INTRODUCTORY COURSES

- 2f,w. **ELEMENTARY SOILS.** An elementary study of the properties of soils as related to crop production. ROST.
- 3s. **SOILS.** Formation, physical properties, and chemical composition of soils; micro-organisms of the soil; farm manures, green manures, commercial fertilizers, and soil amendmets; causes of unproductivity. Lectures, recitations, laboratory, and field work. ALWAY, ROST.

ADVANCED COURSES

- 101f. CHEMICAL ANALYSIS OF SOILS. A laboratory course on the chemical examination of soils, including both fusion and extraction methods for mineral nutrients. ROST.
- 102f,w,s. SPECIAL PROBLEMS IN SOILS. Individual laboratory or field work upon some special soil problem in soil physics, soil chemistry, or soil management. Arrangement must be made in advance. ALWAY.
- 103w. MECHANICAL ANALYSIS OF SOILS. A laboratory course on the beaker, and centrifuge methods of mechanical analysis. McMILLER.
- 104s. SOIL-SURVEYING. Field practice in surveying soils and the preparation of soil maps. McMILLER.
- 105w. MINNESOTA SOILS. Detailed study of the soils of Minnesota. Origin, formation, and classification; physical and chemical characteristics; moisture relations; response to manures, fertilizers, and soil amendments; naturally unproductive types and their reclamation. Lectures, laboratory, and field work. ALWAY.

VETERINARY MEDICINE

ANIMAL INDUSTRY GROUP

Professors CLIFFORD P. FITCH, WILLARD L. BOYD, MYRON H. REYNOLDS;
Assistant Professor HOWARD C. H. KERNKAMP; Instructors WILLIAM
A. BILLINGS, EARL A. HEWITT.

COURSES

No.	Title	Credits	Offered to	Prerequisite courses
<i>Introductory Courses</i>				
2f	Anatomy of Domestic Animals	5	Soph., jr., sr.	None
3w-4s	Comparative Physiology.....	6	Soph., jr., sr.	2
6f	Physiology and Hygiene of Breeding	3	Jr., sr.	3-4
8s	Veterinary Studies.....	5	Soph., jr., sr.	None
12w	Infectious Diseases.....	3	Jr., sr.	3-4, Bact. 1
13s	Non-infectious Diseases.....	3	Jr., sr.	3-4
<i>Advanced Courses</i>				
101w-102s	Advanced Anatomy of Domestic Animals.....	6	Jr., sr.	2 or equiv.
103f-104w	Advanced Comparative Physiology	6	Jr., sr.	3-4 or equiv.

INTRODUCTORY COURSES

- 2f. ANATOMY OF DOMESTIC ANIMALS. Anatomy of the common farm animals with special reference to bones, muscles, and viscera. Lectures and demonstrations. KERNKAMP.

- 3w-4s. **COMPARATIVE PHYSIOLOGY.** A recitation and lecture course in physiology with special reference to the physiology of domesticated animals. Special emphasis is given to digestion and metabolism. HEWITT.
- 6f. **PHYSIOLOGY AND HYGIENE OF BREEDING.** Anatomy and physiology of reproduction. Embryology, obstetrics, sterility, hygiene, and common diseases of breeding animals. BOYD.
- 8s. **VETERINARY STUDIES.** Study of diseases; causes, prevention, treatment of common diseases; simple surgical operations; lameness and unsoundness; common medicines. Planned especially for students taking only one quarter veterinary work. Not open to those who have completed 12-13. REYNOLDS.
- 12w. **INFECTIOUS DISEASES.** Etiology, morbid anatomy, symptomatology, diagnosis, prevention, and the basis of treatment of the common infectious diseases of animals. Special instruction will be given in preparation and use of vaccines, bacterins, serums, and anti-toxins. Those who have completed Course 8 can obtain only half credit for this course. FITCH, BILLINGS.
- 13s. **NON-INFECTIOUS DISEASES.** General principles of diagnosis, causes, morbid anatomy, symptomatology, prevention, and the basis of treatment of the non-infectious diseases of animals. Those who have completed Course 8 can obtain only half credit for this course. BOYD.

ADVANCED COURSES

- 101w-102s. **ADVANCED ANATOMY OF DOMESTIC ANIMALS.** Advanced study of the structures involved in the type, conformation and nutrition of the common farm animals. Dissection of farm animals, including a study of the osseous, muscular, and other principal anatomical structures. KERNKAMP.
- 103f-104w. **ADVANCED COMPARATIVE PHYSIOLOGY.** An advanced course in physiology of the domestic animals, including laboratory work with special emphasis on animal nutrition. HEWITT.

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